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A

KEY

TO THE

NATIONAL ARITHMETIC,

EXHIBITING THE OPERATION OF

THE MORE DIFFICULT QUESTIONS

IN THAT WORK;

FOR THE USE OF TEACHERS ONLY.

By BENJAMIN GREENLEAF, A. M.,

PRINCIPAL OF BRADFORD TEACHERS' SEMINARY.

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PREFACE.

THE object of the author, in this publication, is to aid the teacher in communicating instruction to his pupils, and in detecting any error, which they may have made in the operation of the examples.

Every instructor, who has a large number of scholars under his care, is aware, that it is a great tax on his time, especially when in school, to examine the operation of many arithmetical questions; whereas, by the aid of a Key, he may readily detect any mistake in the operation. Besides, amid the labors of the school-room, it is often very difficult for the most able arithmetician to recollect, at the moment, all the principles involved in the solution of difficult questions; but, by recurring to a Key, this difficulty will be obviated.

The author would recommend to teachers, never to point out *directly* to the pupil the method of solving a problem, nor perform the labor for him, but suggest and explain such principles, as will enable him to perform the question himself.

The answers to all the examples in the Arithmetic are inserted in the Key, for the convenience of those teachers, who may prefer to use the edition of the Arithmetic, which does not contain the answers.

B. GREENLEAF.

Bradford, March 28, 1849.

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KEY

TO

GREENLEAF'S ARITHMETIC.

Section I.

NUMERATION.

1. (p. 17.) 29
2. 407
3. 23,007
4. 5,000,027
5. 7,205,005
6. 2,207,604,009
7. 105,909,308,201
8. 9,000,000,008,000,000,046
9. 15,000,000,000,031,000,017
10. 507,000,000,000,000,203,057,000,018
11. 9,000,000,000,000,000,047,007,002,000,397
12. 15,000,000,000,000,000,000,000,000,010,127,026,320,426

Note. — The above is the French method.

Section II.

ADDITION.

21. (p. 19.)	30530	26.	29340	31.	276605
22.	31643	27.	283649	32.	3980839
23.	26798	28.	300000	33.	4183478
24.	28578	29.	264088	34.	31881050
25.	34383	30.	357477	35.	3837156

36.	4801393	42.	118106	48.	119
37.	5067696	43.	1386486	49.	$228
38.	5640426	44.	65951058	50.	$37443
39.	4344737	45.	62075	51.	94989
40.	4935497	46.	11087	52.	282
41.	1937678	47.	$82871	53.	17068666

SECTION III.

SUBTRACTION.

7. (p. 22.)	5676	30.	
8.	5119	31.	6686136
9.	4409	32.	760702380
10.	2589	33.	31309891
11.	48447	34.	16680605
12.	46698	35.	10014098379
13.	17672	36.	84892699
14.	53859	37.	466426
15.	411001	38.	85748033
16.	426944	39.	1011112
17.	6202102	40.	7152877
18.	799081	41.	8806665
19.	1439	42.	1302440
20.	92690	43.	3671616
21.	243334	44.	85
22.	617441	45.	111
23.	900981	46.	190
24.	98999080	47.	993044
25.	788889	48.	$11810
26.	9393239896461	49.	$14
27.	408881883715	50.	
28.	61475423	51.	173
29.	999999	52.	1026

SECTION IV.

MULTIPLICATION.

5.	(p. 27.) 3156492	42.	204060808060402
6.	6172835	43.	700000000
7.	1979796	44.	7207272072
8.	30316704	45.	63126063000
16.	5433285969	46.	3394240201606
17.	274091971580	47.	169233130080
18.	217120000000	48.	9155270867883O7
19.	5745151000000	49.	454115186861492
20.	3545304	50.	120321091241680O3
21.	584720181340	51.	81000108000036
22.	594731545000	53.	$ 945
23.	1191090948350	54.	$ 26645
24.	406781410014	55.	$ 5529
25.	318697622634	56.	$ 2779
26.	2308964672470	57.	$ 21053
27.	222170629035000	58.	13505 miles.
28.	78043410604000	59.	480 sheets.
29.	137260338494	60.	24336 miles.
30.	1219326311126352G9	61.	$ 4886
31.	213255462816	62.	4888 cts.
32.	4814703649710	63.	9021 cts.
33.	2650726049700	64.	59784 men.
34.	395018272	65.	4552 cts.
35.	9594000000	66.	6975 cts.
36.	70136114040	67.	246018 yards.
37.	162068556600	68.	2784 squares.
38.	5427563769000	69.	12213663 pounds.
39.	475065601536	70.	29657416470704
40.	8794170000	71.	$ 50151
41.	70000000		

SECTION V.

SHORT DIVISION.

	Quotients.	Rem.		Quotients.	Rem.
4. (p. 31.)	16464392	4	16.	23762387	2
5.	1810157	2	17.	20166474	1
6.	4180695	7	18.	17964186	4
7.	137174	1	19.	33081425	3
8.	17898	5	20.	13698246	4
9.	151617	2	21.	26316692	1
10.	763988		22.	169739167	3
11.	33946768		23.	133557795	1
12.	105596437		24.	129629629	3
13.	141973831	2	25.	129684126	6
14.	24691357	4	26.	124999999	7
15.	111946492	1	27.	14285714	2

LONG DIVISION.

CASE I.

	Quotients.	Rem.		Quotients.	Rem.
5. (p. 34.)	193051		20.	12812	21208
6.	17166		21.	29959	2318
7.	153227	44	22.	1000	1000
8.	275175		23.	1620	1279
9.	17327		24.	859	2167762
10.	69255		25.	512	77475
11.	71451		26.	987654321	
12.	8650	111	27.	7060504	4267
13.	90365	28	28.	6017853	2355
14.	4598	297	29.	5000700	1234
15.	226447	174	30.	88888	2341
16.	5091	5091	31.	123000	4321
17.	2149	16919	32.	4001100	6789
18.	1728	43679	33.	6716700	7896
19.	10924	52765	34.	987648	8967

	Quotients.	Rem.		Quotients.	Rem.
35.	18711000	278	41.	4807658	6785
36.	10000	6876	42.	16789001	7856
37.	101010101	2345	43.	304050607	8567
38.	70000	3456	44.	908007004	8765
39.	800008	4567	45.	2003007001	1357
40.	900900	5678			

CASE II.

2. (p. 36.)	5	2100	5.	3	137851
3.	19	127810	6.	11	91853
4.	8	1145678	7.	37	411111

CASE III.

1.	12345678	9	3.	122112347	800
2.	9876543	21	4.	89765	432156

CASE IV.

3. (p. 37.)	320	11	7.	138	45
4.	308	1	8.	273	18
5.	38	38	9	1196	45
6.	507	40			

SECTION VI.

CONTRACTIONS IN MULTIPLICATION.

CASE I.

2. (p. 37.)	246913575	3.	1177768025

CASE II.

5. (p. 38.)	2222233100	6.	411224100

CASE IV.

9.	77769992223	12.	103548794035
10.	5554994445	14.	2304519769548

SECTION VII.

CONTRACTIONS IN DIVISION.

CASE IV.

5. (p. 40.) $70294\frac{312}{1000}$ | 6. $9876\frac{536}{1000}$

CASE V.

8. (p. 41.) 75432 | 9. 789563

CASE VI.

12. 12345 | 13. 98765 | 14. 9123456789

SECTION VIII.

MISCELLANEOUS EXAMPLES.

1. (p. 41.) $1705536 \div 1728 = 987$ Ans.
2. $175686 \div 987 = 178$lbs. Ans.
3. $697800 \div 100 = \$6978$ Ans
4. $111680 \div 16 = 6980$lbs. Ans.
5. $5868 \div 6 = \$978$ Ans.
6. $\$25{,}000 \div 12 = \$2083\frac{1}{3}$ Ans.
7. $\$96 \div 8 = \$12$ Ans.
8. $30 \div 6 = 5$ hours, Ans.
9. $\$8395 \div 365 = \$23$ Ans.
10. $25{,}000 \div 65 = 384\frac{8}{13}$ hours, Ans.
11. $\$405 \div \$15 = 27$cwt. Ans.
12. $6789560 \div 20 = 339478£$. Ans.
13. $31{,}173 \div 365 = 85\frac{148}{365}$ verses, Ans.
14. $123456720 \div 60 = 2057612$ hours, Ans.
15. $\$66{,}144 \div 4 = \$16{,}536$; $\$66{,}144 - \$16{,}536 = \$49{,}608$; $\$49{,}608 \div 4 = \$12{,}402$ Ans.
16. $175 \times \$87 = \$15{,}225$; $\$1234 + \$197 = \$1431$; $\$15{,}225 - \$1431 = \$13{,}794$; $\$13{,}794 \div 22 = \$627$ for a gentleman, Ans.; $\$627 \times 2 = \$1254$ for a lady, Ans.
17. $1086240 \div 160 = 6789$ acres, Ans.
18. $14222160 \div 144 = 98765$ feet, Ans.

19. $2 + 8 = 10$; $10 \times 4 = 40$; $40 + 32 = 72$; $72 \div 2 = 36$; $36 \times 10 = 360$; $360 \div 24 = 15$ Ans.

20. $12 \times 12 \times 6 = 864$; $6 \times 12 = 72$; $864 - 72 = 792$ Ans.

21. $\$7 \times 8 = \$56$; $\$8 \times 3 = \$24$; $\$56 + \$24 = \$80$ Ans.

22. $\$75 + \$87 + \$31 = \$193$; $\$38 + \$12 = \$50$; $\$193 - \$50 = \$143$ Ans.

23. $\$85 \div \$5 = 17$ cords, Ans.

24. $127 \times \$47 = \$5969$; $212 \times \$96 = \$20{,}352$; $212 + 127 = 339$; $500 - 339 = 161$; $161 \times \$37 = \$5957$. $\$20{,}352 + \$5969 + \$5957 = \$32{,}278$; $\$32{,}278 - \$17{,}876 = \$14{,}402$ Ans.

25. $938 \div 7 = 134$ cloaks, Ans.

26. $97 \times \$5 = \$485$; $97 - 17 = 80$; $80 \times \$8 = \$640$; $\$640 - \$485 = \$155$ gain, Ans.

27. $671 \times 12 = 8052$ pence, Ans.

28. $5280 \times 12 = 63360$ inches, Ans.

29. $1728 \times 16 = 27648$ ounces, Ans.

30. $8136 \div 12 = 678$ shillings, Ans.

31. $3787 \times 1728 = 6543936$ inches, Ans.

SECTION X.

COMPOUND ADDITION.

2. (p. 51.) $\$177.66{,}3$.
3. $\$2877.87{,}2$.
5. 141£. 10s. $7\frac{3}{4}$d.
6. 161£. 17s. 7d.
8. 385lb. 7oz. 5dwt. 10gr.
10. 246℔ 10℥ 3ℨ 2℈ 2gr.
12. 233cwt. 1qr. 6lb. 4oz. 5dr.
14. 317m. 3fur. 18rd. 4yd. 2ft. 6in. 0br.
16. 2513E.E. 3qr. 2na. 0in.
18. 317A. 0R. 24p. $13\frac{3}{4}$ft.
20. 378 cords 96ft. 1460in.
22. 286hhd. 42gal. 1qt. 1pt.
24. 784hhd. 24gal. 2qt. 0pt.
26. 240ch. 20bu. 2pk. 7qt.
28. 212y. 11mo. 29d. 4h.
30. 11S. 2° 22′ 42″.
32. 194m. 6fur. 9ch. 0p. 12l.

SECTION XI.

COMPOUND SUBTRACTION.

2. (p. 55.) $491.72,9.
4. 435£. 15s. 9¼d.
6. 38lb. 7oz. 14dwt. 13gr.
8. 5℔ 5℥ 0℥ 1℈ 17gr.
10. 53cwt. 3qr. 23lb. 14oz.
12. 31E.E. 4qr. 2na.
14. 9deg. 4m. 5fur. 37rd. 4yd. 1ft. 4in. 1bar.
16. 3A. 1R. 38p. 18yd. 7ft. 34in.
18. 163 cords 53ft. 1289in.
20. 6hhd. 61gal. 2qt. 1pt.
22. 577hhd. 52gal. 2qt.
24. 26ch. 22bu. 2pk. 4qt.
26. 28y. 11mo. 2w. 4d. 21h. 48m. 35s.
28. 2S. 27° 21′ 54″.
30. 12m. 6fur. 8ch. 0p. 24l.

EXERCISES IN COMPOUND ADDITION AND SUBTRACTION.

1. (p. 58.) 131£. 5s. 8½d.
2. 20£. 17s. 10d.
3. 5lb. 9oz. 4dwt. 20gr.
4. 7℔ 10℥ 3℥ 1℈ 4gr.
5. 63℔ 4℥ 7℥ 2℈ 19gr.
6. 117cwt. 1qr. 19lb.
7. 175yd. 2qr. 2na.

8.

m.	fur.	rd.	yd.	ft.	in.
371	3	37	5	2	10
289	2	18	3	1	9
399	7	0	0	3	11
1060	5	16	4½	2	6
			½ =	1	6
1060	5	16	5	1	0

9. 588A. 1R. 31p.
10. 7S. 29° 33′ 56″.
11. 82 cords 115ft. 487in.
12. 276hhd. 48gal. 1qt.

13.

y.	mo.	w.	d.	h.	m.	s.
14	3	2	5	0	0	0
9	10	3	4	23	12	15
2	1	3	2	0	7	0
26	3	1	4	23	19	15
4	5	3	0	0	47	45

14. 67A. 0R. 38p. 265½ft.
15. 99£. 16s. 5½d.

16.

m.	fur.	rd.	ft.	in.
25,000	0	0	0	0
43	0	17	0	9
24,956	7	22	15½	3
			½ =	6
24,956	7	22	15	9

17. 4 cords 50ft. 0in.
18. 1lyd. 1qr. 3na.
19. 33cwt. 2qr. 23lb.
20. 54gal. 0qt. 1pt.

21.

A.	R.	p.
10	3	10
1	2	13
2	2	5
4	0	18
6	2	32

22.

°	′	″	‴
13	10	35	00
	59	8	20
12	11	26	40

23. 86bu. 1pk. 0qt. 1pt.

24. 1T. 19ft. 1418in.

25.

lb	ʒ	ʒ	ȝ	gr.
1	0	0	0	0
	4	2	0	13
	3	1	2	14
	7	4	0	7
	4	3	2	13

26.

bbl.	gal.	qt.	pt.
18	3	2	0
13	0	0	1
31	3	2	1
5	3	1	1

27.

$	cts.	m.
100	00	0
17	28	5
10	00	5
37	15	0
64	44	0
35	56	

SECTION XII.

REDUCTION DESCENDING.

2. (p. 61.) $127 \times 20 + 15 = 2555 \times 12 + 8 = 30668 \times 4 = 122672$ Ans.

3. $28 \times 20 + 19 = 579 \times 12 + 11 = 6959 \times 4 + 3 = 27839$ Ans.

4. $378 \times 20 = 7560 \times 12 = 90720$ Ans.

5. $28 \times 12 + 11 = 347 \times 20 + 12 = 6952 \times 24 + 15 = 166863$ Ans.

6. $17 \times 12 = 204 \times 20 + 12 = 4092$ Ans.

7. $3 \times 12 + 11 = 47 \times 20 = 940 \times 24 = 22560$ Ans.

8. $23 \times 12 = 276 \times 8 = 2208 \times 3 = 6624$ Ans.

9. $3 \times 20 + 16 = 76 \times 4 + 2 = 306 \times 28 + 18 = 8586 \times 16 = 137376$ Ans.

10. $2 \times 20 + 17 = 57 \times 4 + 3 = 231 \times 28 + 16 = 6484 \times 16 + 15 = 103759 \times 16 + 13 = 1660157$ Ans.

11. $57 \times 4 = 228 \times 4 = 912$ Ans.

12. $83947 \times 5 + 4 = 419739 \times 4 = 1678956$ Ans.

13. $2263 \times 3 + 2 = 6791$ Ans.

14. $79 \times 8 = 632 \times 40 = 25280 \times 16\frac{1}{2} = 417120$ Ans.

15. $396 \times 40 = 15840 \times 16\frac{1}{2} = 261360 \times 12 = 3136320$ Ans.

16. $30 \times 8 = 240 \times 40 = 9600 \times 16\frac{1}{2} = 158400 \times 12 = 1900800$ Ans.

17. $360 \times 69\frac{1}{2} = 25020 \times 8 = 200160 \times 40 = 8006400 \times 16\frac{1}{2} = 132105600 \times 12 = 1585267200 \times 3 = 4755801600$ Ans.

18. $403 \times 8 + 7 = 3231 \times 40 + 35 = 129275 \times 5\frac{1}{2} + 2 = 711014\frac{1}{2} \times 3 = 2133043\frac{1}{2} \times 12 = 25596522 \times 3 + 1 = 76789567$ Ans.

19. $413 \times 3 + 2 = 1241 \times 8 + 2 = 9930 \times 40 + 38 = 397238 \times 5\frac{1}{2} + 1 = 2184810 \times 3 = 6554430 \times 12 + 1 = 78653167$ Ans.

20. $144 \times 8 + 1 = 1153 \times 40 + 8 = 46128 \times 5\frac{1}{2} + 1 = 253705 \times 3 + 1 = 761116$ Ans.

21. $1051 \times 3 + 2 = 3155 \times 12 + 5 = 37865$ Ans.

22. $3576 \times 40 + 12 = 143052 \times 5\frac{1}{2} + 3 = 786789$ Ans.

23. $25 \times 160 = 4000 \times 272\frac{1}{4} = 1089000$ Ans.

24. $365 \times 640 = 233600 \times 160 = 37376000$ Ans.

25. $196563942 \times 640 = 125800922880 \times 160 = 20128147660800 \times 272\frac{1}{4} = 5479888200652800 \times 144 = 789,103,900,894,003,200$ Ans.

26. $10 \times 4 + 3 = 43 \times 40 + 38 = 1758 \times 30\frac{1}{4} + 6 = 53185\frac{1}{2} \times 9 + 5 = 478674\frac{1}{2} + 72$in. or $\frac{1}{2}$ft. $= 478675$ Ans.

27. $2 \times 40 = 80 \times 30\frac{1}{4} + 24 = 2444 \times 9 + 3 = 21999 \times 144 = 3167856$ Ans.

28. $1 \times 4 + 3 = 7 \times 40 + 34 = 314 \times 30\frac{1}{4} + 27 = 9525\frac{1}{2} \times 9 + 4 = 85733\frac{1}{2} \times 144 + 54 = 12345678$ Ans.

29. $17 \times 128 = 2176 \times 1728 = 3760128$ Ans.

30. $19 \times 40 = 760 \times 1728 = 1313280$ Ans.

31. $128 \times 128 = 16384$ Ans.

32. $4899 \times 63 + 4 = 308641 \times 4 + 3 = 1234567$ Ans.

33. $1224 \times 2 + 1 = 2449 \times 2 + 1 = 4899 \times 63 + 19 = 308656 \times 4 + 1 = 1234625 \times 2 = 2469250 \times 4 + 1 = 9877001$ Ans.

34. $790 \times 2 = 1580 \times 63 + 58 = 99598 \times 4 = 398392 \times 2 + 1 = 796785$ Ans.

35. $460 \times 2 + 1 = 921 \times 54 + 31 = 49765$ Ans.

36. $36 \times 54 + 26 = 1970 \times 4 + 3 = 7883 \times 2 + 1 = 15767$ Ans.

37. $16 \times 40 = 640 \times 1728 = 1105920$ Ans.

38. $365\frac{1}{4} \times 24 = 8766 \times 60 = 525960 \times 60 = 31557600$; $2348 + 1835 = 4183 \times 31557600 = 132005440800$ Ans.

39. June 13 + July 31 + August 31 + September 30 + October 31 + November 30 + December 31 + January 31 + February 16 + 365 + 365 = 974 days, Ans.

40. $676 \times 36 = 24336 \times 4 = 97344$ pecks, Ans.

41. $657 \times 10 = 6570$ mills, Ans.

42. $3165 \times 100 = 316500$ mills, Ans.

43. $63 \times 100 = 6300$ cents, Ans.

44. $27 \times 10 \times 100 \times 10 = 270000$ mills, Ans.

REDUCTION ASCENDING.

2. (p. 63.) $122672 \div 4 = 30668$d. $\div 12 = 2555$s. 8d. $\div 20 = 127$£. 15s. 8d. Ans.

3. $27839 \div 4 = 6959\frac{3}{4}$d. $\div 12 = 579$s. 11d. $\div 20 = 28$£. 19s. $11\frac{3}{4}$d. Ans.

4. $90720 \div 12 = 7560$s. $\div 20 = 378$£. Ans.

5. 166863 ÷ 24 = 6952dwt. 15gr. ÷ 20 = 347oz. 12dwt. ÷ 12 = 28lb. 11oz. 12dwt. 15gr. Ans.

6. 4092dwt. ÷ 20 = 204oz. 12dwt. ÷ 12 = 17lb. 0oz. 12dwt. Ans.

7. 22560 ÷ 24 = 940dwt. ÷ 20 = 47oz. ÷ 12 = 3lb. 11oz. Ans.

8. 6624 ÷ 3 = 2208$\frac{3}{3}$. ÷ 8 = 276$\frac{3}{3}$. ÷ 12 = 23lb. Ans.

9. 137376 ÷ 16 = 8586lb. ÷ 28 = 306qr. 18lb. ÷ 4 = 76cwt. 2qr. ÷ 20 = 3 tons, 16cwt. 2qr. 18lb. Ans.

10. 1660157 ÷ 16 = 103759oz. 13dr. ÷ 16 = 6484lb. 15oz. ÷ 28 = 231qr. 16lb. ÷ 4 = 57cwt. 3qr. ÷ 20 = 2T. 17cwt. 3qr. 16lb. 15oz. 13dr. Ans.

11. 912 ÷ 4 = 228qr. ÷ 4 = 57yd. Ans.

12. 1678956 ÷ 4 = 419739qr. ÷ 5 = 83947EE. 4qr. Ans.

13. 6791 ÷ 3 = 2263EF. 2qr. Ans.

14. 417120 ÷ 16$\frac{1}{2}$ = 25280rd. ÷ 40 = 632fur. ÷ 8 = 79m. Ans.

15. 3136320 ÷ 12 = 261360ft. ÷ 16$\frac{1}{2}$ = 15840rd. ÷ 40 = 396fur. Ans.

16. 1900800 ÷ 12 = 158400ft. ÷ 16$\frac{1}{2}$ = 9600rd. ÷ 40 = 240fur. ÷ 8 = 30m. Ans.

17. 4755801600 ÷ 3 = 1585267200in. ÷ 12 = 132105600ft. ÷ 16$\frac{1}{2}$ = 8006400rd. ÷ 40 = 200160fur. ÷ 8 = 25020m. ÷ 69$\frac{1}{2}$ = 360deg. Ans.

18. 76789567 ÷ 3 = 25596522in. 1br. ÷ 12 = 2133043ft. 6in. ÷ 3 = 711014yd. 1ft. ÷ 5$\frac{1}{2}$ = 129275rd. 1$\frac{1}{2}$yd. ÷ 40 = 3231fur. 35rd. ÷ 8 =

403m. 7fur. 35rd. 1$\frac{1}{2}$yd. 1ft. 6in. 1br.
$\frac{1}{2}$yd. = 1ft. 6in. 0br.

403m. 7fur. 35rd. 2yd. 0ft. 0in. 1br. Ans.

19. 78653167 ÷ 12 = 6554430ft. 7in. ÷ 3 = 2184810yd. ÷ 5$\frac{1}{2}$ = 397238rd. 1yd. ÷ 40 = 9930fur. 38rd. ÷ 8 = 1241m. 2fur. ÷ 3 = 413L. 2m. 2fur. 38rd. 1yd. 0ft. 7in. Ans.

20. 761116 ÷ 3 = 253705yd. 1ft. ÷ 5½ = 46128rd. 1yd. ÷ 40 = 1153fur. 8rd. ÷ 8 = 144m. 1fur. 8rd. 1yd. 1ft. Ans.

21. 37865 ÷ 12 = 3155ft. 5in. ÷ 3 = 1051yd. 2ft. Ans.

22. 786789 ÷ 5½ = 143052rd. 3yd. ÷ 40 = 3576fur. 12rd. 3yd. Ans.

23. 1089000 ÷ 272½ = 4000rd. ÷ 160 = 25A. Ans.

24. 37376000 ÷ 160 = 233600A. ÷ 640 = 365 square miles, Ans.

25. 789,103,900,894,003,200 ÷ 144 = 5479888200652-800ft. ÷ 272¼ = 20128147660800rd. ÷ 160 = 125800922880A. ÷ 640 = 196563942 square miles, Ans.

26. 478675 ÷ 9 = 53186yd. 1ft. ÷ 30¼ = 1758rd. 6½yd. ÷ 40 = 43R. 38rd. ÷ 4 =

10A. 3R. 38rd. 6½yd. 1ft.
½yd. = 4ft. 72in.

10A. 3R. 38rd. 6yd. 5ft. 72in. Ans.

27. 3167856 ÷ 144 = 21999ft. ÷ 9 = 2444yd. 3ft. ÷ 30¼ = 80rd. 24yd. ÷ 40 = 2R. 0rd. 24yd. 3ft. Ans.

28. 12345678 ÷ 144 = 85733ft. 126in. ÷ 9 = 9525yd. 8ft. ÷ 30¼ = 314p. 26½yd. ÷ 40 = 7R. 34p. ÷ 4 =

1A. 3R. 34p. 26½yd. 8ft. 126in.
½yd. = 4ft. 72in.

1A. 3R. 34p. 27yd. 4ft. 54in. Ans.

29. 3760128 ÷ 1728 = 2176ft. ÷ 128 = 17 cords, Ans

30. 1313280 ÷ 1728 = 760ft. ÷ 40 = 19 tons, Ans.

31. 16384 ÷ 128 = 128 cords, Ans.

32. 1234567 ÷ 4 = 308641gal. 3qt. ÷ 63 = 4899hhd. 4gal. 3qt. Ans.

33. 9877001 ÷ 4 = 2469250pt. 1gi. ÷ 2 = 1234625qt. ÷ 4 = 308656gal. 1qt. ÷ 63 = 4899hhd. 19gal. ÷ 2 = 2449pi. 1hhd. ÷ 2 = 1224T. 1pi. 1hhd. 19gal. 1qt. 0pt. 1gi. Ans.

34. 796785 ÷ 2 = 398392qt. 1pt. ÷ 4 = 99598qt. ÷ 63

= 1580hhd. 58gal. ÷ 2 = 790pi. 0hhd. 58gal. 0qt. 1pt. Ans.

35. 49765 ÷ 54 = 921hhd. 31gal. ÷ 2 = 460 butts, 1hhd. 31gal. Ans.

36. 15767 ÷ 2 = 7883qt. 1pt. ÷ 4 = 1970gal. 3qt. ÷ 54 = 36hhd. 26gal. 3qt. 1pt. Ans.

37. 1105920 ÷ 1728 = 640ft. ÷ 40 = 16 tons, Ans.

38. 132005440800 ÷ 60 = 2200090680m. ÷ 60 = 36668178h. ÷ 24 = 1527840¾ days, ÷ 365¼ = 4183 years.

39. 974 ÷ 365 = 2 years, 244 days, Ans.

40. 97344 ÷ 4 = 24336bu. ÷ 36 = 676chald. Ans.

41. 6570 ÷ 10 = 657 cents, Ans.

42. 316500 ÷ 100 = 3165 dimes, Ans.

43. 6300 ÷ 100 = $63 Ans.

44. 270000 ÷ 10 = 27000 cts. ÷ 100 = $270 ÷ 10 = 27 Eag. Ans.

COMPOUND REDUCTION.

1. (p. 64.) 57£. 15s. = 1155s. ÷ 6 = $192.50.

2. 67£. 14s. 9d. = 16257d.; 6s. 7d. = 79d.; 16257 ÷ 79 = 205cr. 62d. = 5s. 2d. Ans.

3. $678 × 6 = 4068s. ÷ 20 = 203£. 8s. Ans.

4. 761 × 4 = 3044qr. ÷ 5 = 608EE. 4qr. Ans.

5. 61 × 3 = 183qr. ÷ 4 = 45yd. 3qr. Ans.

6. 63 × 4 = 252 × 2 = 504 ÷ 3 = 168 bottles, Ans.

7. 15 × 1760 = 26400yd. × 3 = 79200ft. × 12 = 950400in.; 2ft. 8in. = 32in. 950400 ÷ 32 = 29700 steps, Ans.

8. 2oz. 12dwt. = 52dwt.; 5lb. 2oz. 8dwt. = 1248dwt. ÷ 52 = 24 spoons, Ans.

9. 14ft. 9in. = 177in.; 436 × 1760 = 767360yd. × 3 = 2302080ft. × 12 = 27624960in.; 27624960 ÷ 177 = 156073$\frac{39}{177}$ times, Ans.

10. $123 \times 78 = 9594$ hills, $\times 4 = 38376$ ears, $\div 8 = 4797$qt. $\div 8 = 599$pk. 5qt. $\div 4 = 149$bu. 3pk. 5qt. Ans.

11. 5yd. 2qr. 3na. $= 91$na.; 182yd. $= 2912$na. $\div 91 = 32$ suits, Ans.

12. 5dwt. 10gr. $= 130$gr.; 3lb. 1oz. 2dwt. 2gr. $= 17810$gr. $\div 130 = 137$ rings, Ans.

13. $18 \div 3 = 6 \times 4 = 24$in.; $56 \times 60 \times 144 = 483840$in. $\div 24 = 20160$ shingles, Ans.

14. $56 \times 25 \times 2 = 2800$ feet, $\times 6 = 16800$ shingles, Ans.

15. 22m. 3fur. 17rd. $= 7177$rd.; 25000m. $= 8000000$rd. $\div 7177 = 1114\frac{4222}{7177}$ days, Ans.

16. 7lb. 10oz. $= 122$oz.; 10cwt. 3qr. 16lb. $= 19520$oz. $\div 122 = 160$ weeks, Ans.

17. 3T. 17cwt. 3qr. 18lb. $= 87261$b. $\times 7 = 610821$d. $= 254$£. 10s. 2d. Ans.

18. 5cwt. 1qr. 10lb. $= 598$lb. $\times 4\frac{1}{2} = 2691$d. $= 11$£. 4s. 3d. Ans.

19. $63 \times 4 \times 7 \times 9 = \$158.76$ Ans.

20. $54 \times 4 \times 2 \times 15 \times 3 = \$194.40$ Ans.

21. $73 \times 4 \times 8 = 2336$qt. $\times 2 = \$46.72$ Ans.

22. $29 \times 57 = 1653$yd. $\times 15 = \$247.95$ Ans.

23. 6cwt. 2qr. 11lb. + 5cwt. 3qr. 16lb. + 7cwt. 0qr. 7lb. + 3cwt. 1qr. 17lb. $= 22$cwt. 3qr. 23lb. $= 2571$lb. $\times 15 = \$385.65$ Ans.

24. 12cwt. $= 1344$lb.; 3cwt. 2qr. 11lb. + 4cwt. 1qr. 15lb. $= 7$cwt. 3qr. 26lb. $= 894$lb.; $1344 - 894 = 450$lb. $\times 15 = \$67.50$ Ans.

25. 2cwt. 1qr. 7lb. + 3cwt. 2qr. 15lb. + 2cwt. 0qr. 20lb. + 5cwt. 3qr. 17lb. $= 14$cwt. 0qr. 3lb. $= 1571$lb. $\times 37\frac{1}{2} = \$589.12\frac{1}{2}$ Ans.

26. $87 \times 63 = 5481$gal. $\times 33 = \$1808.73$ Ans.

27. 10gal. 1qt. 1pt. 3gi. $= 335$gi.; $63 \times 4 = 252$qt. $\times 2 = 504$pt. $\times 4 = 2016$gi. $- 335$gi. $= 1681$gi. $\times 6 = \$100.86$ Ans.

28. 100A. 3R. 15p. + 161A. 2R. 28p. + 360A. 3R. 5p. = 623A. 1R. 8p.; 112A. 3R. 30p. + 316A. 1R. 18p. + 168A. 3R. 13p. = 598A. 0R. 21p.; 623A. 1R. 8p. — 598A. 0R. 21p. = 25A. 0R. 27p. = 4027p. × 1.35 = $ 5436.45 Ans.

29. 87gal. 1qt. — 13gal. = 74gal. 1qt. = 2376gi. × .01 = $ 23.76 Ans.

30. 25cwt. 0qr. 17lb. + 37cwt. 2qr. 17lb. + 18cwt. 3qr. 14lb. + 37cwt. 1qr. 17lb. = 119cwt. 0qr. 9lb. = 13337lb. × .02 = $ 266.74 Ans.

REDUCTION OF THE OLD NEW ENGLAND CURRENCY TO UNITED STATES MONEY.

4. (p. 67.)
3)315000
$ 1050.00 Ans.

5.
3)619000
$ 2063.33⅓ Ans.

6.
3)166000
$ 553.33⅓ Ans.

7.
3)318000
$ 1060.00 Ans.

8.
3)101000
$ 336.66⅔ Ans.

9.
3)144000
$ 480.00 Ans.

10.
3)161900
$ 539.66⅔ Ans.

11.
3)361850
$ 1206.16⅔ Ans.

12.
3)99550
$ 331.83⅓ Ans.

13.
3)100450
$ 334.83⅓ Ans.

14.
3)661350
$ 2204.50 Ans.

15.
3)47550
$ 158.50 Ans.

16.
3)109050
$ 363.50 Ans.

17.
16850
26
1
3)16877
$ 56.25⅔ Ans.

18.
69050
13
1
3)69064
$ 230.21⅓ Ans.

19.
87800
44
2
3)87846
$292.82 Ans.

20.
14350
30
1
3)14381
$47.93⅓ Ans.

21.
73150
18
1
3)73169
$243.89⅓ Ans.

22.
47600
40
2
3)47642
$158.80⅔ Ans.

23.
187250
3
3)187253
$624.17⅔ Ans.

24.
10000
13
1
3)10014
$33.38 Ans.

SECTION XIII.

UNITED STATES MONEY.

ADDITION.

1. (p. 68.)	$1829.16,4.	5.	$1717.06,2.
2.	$328.72,2.	6.	$154.35,5.
3.	$1805.84,7.	7.	$7.10,5.
4.	$2320.67,5.		

SUBTRACTION.

1. (p. 69.)	$781.24,3.	6.	$13.87,5.
2.	$278.48,6.	7.	$909.75,0.
3.	$69.06,6.	8.	$3.43,0.
4.	$154.06,9.	9.	$2.36,0.
5.	$2058.08,0.		

MULTIPLICATION.

3. (p. 70.)	$16.38.	4.	$58.59.

5.	$591.25.	30.	$272.16.
6.	$3.35,8.	31.	$424.58,8.
7.	$249.28.	32.	$119.34.
8.	$1120.32.	33.	$15.13.
9.	$358.28.	34.	$176.25.
10.	$102.69.	35.	$368.48.
11.	$44.74,8.	36.	$23.40.
12.	$109.25.	37.	$196.56.
13.	$790.92.	38.	$197.23.
14.	$65.10.	39.	$303.42.
15.	$142.02.	40.	$138.07,5.
16.	$48.22,2.	41.	$1106.77.
17.	$48910.95.	42.	$95.55.
18.	$67.16.	43.	$434.35.
19.	$70.66,4.	44.	$23.36.
20.	$20.63,1.	45.	$290.72.
21.	$217.25.	46.	$337.44.
22.	$1133.99.	47.	$3930.25.
23.	$90.74,4.	48.	$266.40.
24.	$863.75.	49.	$107.16.
25.	$17.07,2.	50.	$49.14.
26.	$2023.56.	51.	$46.50.
27.	$454.61.	52.	$57.80.
28.	$10043.71,2.	53.	$168.35.
29.	$2610.67,2.	54.	$26.12,5.

DIVISION.

2. (p. 73.)	$0.95.	8.	$20.00.
3.	$0.12.	9.	$4.25.
4.	$0.75.	10.	$1.75.
5.	$2.75.	11.	$0.06.
6.	$0.75.	12.	$3.75.
7.	$4.00.	13.	$2.28.

14.	$3.89.	22.	$1.62,5.
15.	$1.25.	23.	$0.67.
16.	$1.19.	24.	$5.68.
17.	$4.68.	25.	$1.62,5.
18.	$0.18.	26.	$37.75.
19.	$132.55.	27.	$6.79.
20.	$1.12.	28.	$69.74,8.
21.	$5.63.		

BILLS.

1. (p. 74.)

$0.45 × 17 =	$7.65
0.37 × 19 =	7.03
0.46 × 16 =	7.36
0.87 × 13 =	11.31
0.63 × 9 =	5.67
0.56 × 25 =	14.00
0.31 × 17 =	5.27
0.16 × 19 =	3.04
	$61.33

2.

$0.98 × 13 =	$12.74
0.15 × 16 =	2.40
0.13 × 36 =	4.68
0.09 × 47 =	4.23
0.19 × 12 =	2.28
0.17 × 7 =	1.19
0.61 × 13 =	7.93
	$35.45

3.

$5.25 × 17 =	$89.25
1.62 × 29 =	46.98
0.17 × 60 =	10.20
0.27 × 49 =	13.23
3.19 × 18 =	57.42
2.75 × 27 =	74.25
0.61 × 75 =	45.75
0.75 × 36 =	27.00
0.18 × 49 =	8.82
	$372.90

4.

$2.75 × 10 =	$27.50
1.25 × 19 =	23.75
1.29 × 83 =	107.07
0.17 × 47 =	7.99
0.39 × 91 =	35.49
0.23 × 47 =	10.81
0.13 × 68 =	8.84
1.39 × 27 =	37.53
	$258.98

5.

$0.19	× 27 =	$5.13
0.27	× 25 =	6.75
0.75	× 17 =	12.75
3.75	× 9 =	33.75
4.50	× 8 =	36.00
2.25	× 27 =	60.75
9.87	× 18 =	177.66
0.31	× 75 =	23.25
0.75	× 67 =	50.25
1.12	× 15 =	16.80
		$423.09

6.

$0.67	× 14 =	$9.38
0.89	× 23 =	20.47
1.25	× 17 =	21.25
2.17	× 25 =	54.25
0.61	× 27 =	16.47
0.27	× 56 =	15.12
		$136.94

7.

$4.50	× 7½ =	$33.75
0.16	× 16¾ =	2.68
0.25	× 18¼ =	4.56¼
0.17	× 30 =	5.10
0.19	× 3 =	0.57
0.18	× 7½ =	1.35
		$48.01¼

8.

$25.50	× 37 =	$943.50
16.17	× 41 =	662.97
97.75	× 40 =	3910.00
169.37	× 13 =	2201.81
		$7718.28

9.

$6.25	× 97 =	$606.25
5.95	× 167 =	993.65
6.07	× 87 =	528.09
5.75	× 196 =	1127.00
7.25	× 275 =	1993.75
1.16	× 69 =	80.04
0.67	× 136 =	91.12
0.76	× 68 =	51.68
1.37	× 169 =	231.53
9.67	× 76 =	734.92
69.70	× 89 =	6203.30
3.47	× 49 =	170.03
1.61	× 39 =	62.79
0.17	× 197 =	33.49
0.69	× 86 =	59.34
1.17	× 78 =	91.26
0.85	× 187 =	158.95
11.61	× 91 =	1056.51
17.15	× 83 =	1423.45
3.16	× 47 =	148.52
18.15	× 35 =	635.25
9.47	× 47 =	445.09
6.83	× 57 =	389.31
		$17315.32

SECTION XIV.

COMPOUND MULTIPLICATION.

2. (p. 78.) 10£. 13s. 0d.
3. 10£. 0s. 4½d.
4. 3£. 2s. 4d.
5. 54yd. 2qr. 3na.
6. 29cwt. 3qr. 16lb.
7. 37T. 17cwt. 0qr. 16lb.
8. 76da. 11h. 53m.
9. 75£. 6s. 6d.
10. 124£. 13s. 10d.
11. 251£. 19s. 7½d.
12. 212£. 1s. 7¾d.
13. 653£. 18s. 0d.
14. 111£. 8s. 11d.
15. 159£. 4s. 9d.
16. 158lb. 9oz. 1dwt. 21gr.
17. 111lb. 11oz. 17dwt. 9gr.
18. 183T. 1cwt. 2qr. 11lb. 4oz.
19. 105T. 7cwt. 0qr. 6lb. 8oz.
20. 19℔ 9℥ 4ʒ 2℈ 9gr.
21. 335yd. 2qr. 0na. 0½in.
22. 215m. 7fur. 1rd. 14ft. 6in.
23. 149deg. 8m. 0fur. 0rd. 1yd. 1ft. 6in.
24. 97deg. 55m. 7fur. 35rd. 4ft. 2in. 1bar.
25. 181A. 3R. 11p. 6yd. 4ft. 41in.
26. 31 cords 83ft. 1332in.
27. 209hhd. 55gal. 3qt. 0pt. 1gi.
28. 35 tuns 3hhd. 4gal. 2qt.
29. 56hhd. 45gal.
30. 118bu. 1pk. 5qt.
31. 255ch. 24bu. 3pk. 1qt.
32. 110y. 343da. 3h. 41m. 12sec.
33. 214A. 3R. 12p.
34. 3da. 16h. 54m.
35. 29 bushels.

37.

£.	s.	d.	
0	3	8	
		4	
0	14	8	= price of 4yd.
		4	
2	18	8	= price of 16yd.

38.

£.	s.	d.	
0	19	11	
		8	
7	19	4	= price of 8yd.
		9	
71	14	0	= price of 72yd.

39.

£.	s.	d.	
0	1	11	
		7	
0	13	5	= price of 7yd.
		12	
8	1	0	= price of 84yd.

40.

T.	cwt.	qr.	lb.	
0	12	2	11	
			9	
5	13	1	15	= weight of 9hhd.
			10	
56	13	3	10	= weight of 90hhd.

41.

£.	s.	d.	qr.	
0	5	9	2	
			3	
0	17	4	2	= price of 3 sheep.
			6	
5	4	3	0	= price of 18 sheep.

42.

£.	s.	d.	
0	9	11	
		7	
3	9	5	= price of 7yd.
		3	
10	8	3	= price of 21yd.

43.

£.	s.	d.	
0	11	6	
		11	
6	6	6	= price of 11 hats.
		2	
12	13	0	= price of 22 hats.

44.

£.	s.	d.	qr.	
13	8	9	2	
			12	
161	5	6	0	= price of 12 [shares.
			8	
1290	4	0	0	= price of 96 [shares.

45.

lb.	oz.	dwt.	gr.	
0	3	5	15	
			12	
3	3	7	12	= weight of 12 spoons.
			10	
32	9	15	0	= weight of 120 spoons.

46.

m.	fur.	rd.	
24	7	4	
		5	
124	3	20	= 5 days.
		6	
746	5	0	= 30 days

47.

°	′	
0	15	
	10	
2	30	= 10 minutes.
	6	
15	0	= 60 minutes.

48.

A.	R.	p.	yd.	ft.	in.	
39	3	17	30	8	100	
					8	
318	3	24	5	6	80	
					4	
1275	2	16	22	8	32	Ans.

49.

y.	d.	h.	m.	s.	
0	2	5	17	19	
				10	
0	22	4	53	10	= 10 deg.
				6	
0	133	5	19	0	= 60 deg.
				6	
2	68½	7	54	0	= 360 deg.
	½=12				= ½ day.
2	68	19	54	0	= 360 deg.

52.

A.	R.	p.	
117	3	27	
		7	
825	1	29	= 7 lots.
		4	
3301	2	36	= 28 lots.
117	3	27	= 1 lot.
3419	2	23	= 29 lots.

54.

hhd.	gal.	qt.	pt.	
0	47	3	1	× 3
			7	
5	20	0	1	= 7 casks.
			8	
42	35	0	0	= 56 casks.
2	17	2	1	= 3 casks.
44	52	2	1	= 59 casks.

56.

gal.	qt.	pt.	
3	1	1	× 2
		10	
33	3	0	= 10 weeks.
		5	
168	3	0	= 50 weeks.
6	3	0	= 2 weeks.
175	2	0	= 52 weeks.

51.

£.	s.	d.	qr.	
0	8	3	1	
			8	
3	6	2	0	= price of 8 gal.
			7	
23	3	2	0	= price of 56 gal.
	8	3	1	= price of 1 gal.
23	11	5	1	= price of 57 gal.

53.

yd.	qr.	na.	in.	
37	3	2	2	
			11	
417	0	3	1⅜	= 11 pieces.
			8	
3337	3	2	0½	= 88 pieces.
37	3	2	2	= 1 piece.
3375	3	1	0½	= 89 pieces.

55.

m.	fur.	rd.	ft.	
17	3	13	14	× 5
			6	
104	4	3	1½	= 6 days.
			6	
627	0	18	9	= 36 days.
			10	
6270	4	25	7½	= 360 days.
87	0	29	4	= 5 days.
6357	5	14	11½	= 365 days.

57.

T.	ft.	in.	
0	37	978	
		8	
7	20	912	= 8 sticks.
		2	
15	1	96	= 16 sticks.
	37	978	= 1 stick.
15	38	1074	= 17 sticks.

58.

Cords.	ft.	
7	98	
	8	
62	16	= 8 piles.
	2	
124	32	= 16 piles.
7	98	= 1 pile.
132	2	= 17 piles.

59.

hhd.	gal.	qt.	pt.	
2	19	0	1	× 3
			6	
13	51	3	0	= 6
			6	
82	58	2	0	= 36
6	57	1	1	= 3
89	52	3	1	= 39

60.

bu.	pk.	qt.	pt.	gl.	
3	1	4	1	1	× 3
				10	
33	3	6	0	2	= 10
				5	
169	2	7	0	2	= 50
10	0	5	1	3	= 3
179	3	5	0	1	= 53

61.

ch.	bu.	qk.	qt.	pt.	
16	7	2	0	0	× 1
				8	
129	24	0	0	0	= 8
				2	
259	12	0	0	0	= 16
16	7	2	0	0	= 1
275	19	2	0	0	= 17

BILLS.

1. (p. 81.) London, July 4, 1835.

Dow, Vance, & Co., of Boston, U. S.,

Bought of Samuel Snow,

			£.	s.	d.
45 yds.	Broadcloth, at	8s. 4d.,	18	15	0
50 "	" "	10s. 6d.,	26	5	0
56 "	" "	3s. 7½d.,	10	3	0
63 "	" "	12s. 11¾d.,	40	17	8¼
72 "	" "	19s. 11d.,	71	14	0
81 "	" "	9s. 3d.,	37	9	3
35 "	" "	19s. 7½d.,	34	6	10½
99 "	" "	16s. 0½d.,	79	8	1½
66 "	" "	8s. 11d.,	29	8	6
33 "	" "	16s. 11½d.,	27	19	7½
			376£.	7s.	0¾d

OPERATION.

1. £.	s.	d.	2. £.	s.	d.	3. £.	s.	d.	qr.	4. £.	s.	d.	qr.	5. £.	s.	d.
0	8	4	0	10	6	0	3	7	2	0	12	11	3	0	19	11
		9			10				7				9			9
3	15	0	5	5	0	1	5	4	2	5	16	9	3	8	19	3
		5			5				8				7			8
18	15	0	26	5	0	10	3	0	0	40	17	8	1	71	14	0

6. £.	s.	d.	7. £.	s.	d.	qr.	8. £.	s.	d.	qr.	9. £.	s.	d.	10. £.	s.	d.	qr.
0	9	3	0	19	7	2	0	16	0	2	0	8	11	0	16	11	2
		9				7				11			11				11
4	3	3	6	17	4	2	8	16	5	2	4	18	1	9	6	6	2
		9				5				9			6				3
37	9	3	34	6	10	2	79	8	1	2	29	8	6	27	19	7	2

2. Quebec, Jan. 8, 1835.

Mr. John Vose,

Bought of Vans & Conant,

				£.	s.	d.
46 Ivory Combs,	at	3s.	5¼d.,	7	18	1½
47 lbs. Colored Thread,	"	6s.	9¼d.,	15	18	2¾
51 yds. Durant,	"	1s.	8d.,	4	5	0
52 Silk Vests,	"	6s.	7d.,	17	2	4
53 Leghorns,	"	11s.	9½d.,	31	4	11½
57 ps. Nankin,	"	8s.	3¼d.,	23	11	5¼
58 lbs. White Thread,	"	9s.	11¼d.,	28	16	4½
				128£.	16s.	5½d.

OPERATION.

1. £.	s.	d.	qr.	2. £.	s.	d.	qr.	3. £.	s.	d.	4. £.	s.	d.
0	3	5	1×1	0	6	9	1×2	0	1	8×1	0	6	7×2
			9				9			10			10
1	10	11	1	3	0	11	1	0	16	8	3	5	10
			5				5			5			5
7	14	8	1	15	4	8	1	4	3	4	16	9	2
0	3	5	1	0	13	6	2	0	1	8	0	13	2
7	18	1	2	15	18	2	3	4	5	0	17	2	4

5.

£.	s.	d.	qr.	
0	11	9	2	× 3
			10	
5	17	11	0	
			5	
29	9	7	0	
1	15	4	2	
31	4	11	2	

6.

£.	s.	d.	qr.	
0	8	3	1	× 1
			8	
3	6	2	0	
			7	
23	3	2	0	
0	8	3	1	
23	11	5	1	

7.

£.	s.	d.	qr.	
0	9	11	1	× 2
			7	
3	9	6	3	
			8	
27	16	6	0	
0	19	10	2	
28	16	4	2	

3.

Montreal, July 4, 1835.

Mr. James Savage,

Bought of Joseph Dowe,

			£.	s.	d.
83 gals.	Lisbon Wine,	at 6s. 7d.,	27	6	5
85 "	Port do.	" 3s. 9½d.,	16	2	3½
86 "	Madeira do.	" 4s. 11½d.,	21	6	5
87 "	Temperance do.	" 3s. 6½d.,	15	8	1½
89 "	Oil,	" 5s. 3d.,	23	7	3
91	Leghorns,	" 19s. 10¼d.,	90	6	8¾
92 lbs.	Green Tea,	" 3s. 1½d.,	14	7	6
93 pair	Thread Hose,	" 4s. 4½d.,	20	6	10½
94 "	Silk Gloves,	" 3s. 3½d.,	15	9	5
95 "	Silk Hose,	" 6s. 6½d.,	31	1	5½
97 yds.	Linen,	" 5s. 5½d.,	26	9	5½
98 gals.	Winter-strained Oil,	" 7s. 7½d.,	37	7	3
			338£.	19s.	2¼d.

OPERATION.

1.

£.	s.	d.	
0	6	7	× 2
		9	
2	19	3	
		9	
27	13	3	
0	13	2	
27	6	5	

2.

£.	s.	d.	qr.	
0	3	9	2	× 5
			10	
1	17	11	0	
			8	
15	3	4	0	
0	18	11	2	
16	2	3	2	

3.

£.	s.	d.	qr.	
0	4	11	2	× 6
			10	
2	9	7	0	
			8	
19	16	8	0	
1	9	9	0	
21	6	5	0	

4.

£.	s.	d.	qr.	
0	3	6	2	× 3
			12	
2	2	6	0	
			7	
14	17	6	0	
0	10	7	2	
15	8	1	2	

5.

£.	s.	d.	
0	5	3	×1
		11	
2	17	9	
		8	
23	2	0	
0	5	3	
23	7	3	

6.

£.	s.	d.	qr.	
0	19	10	1	×1
			10	
9	18	6	2	
			9	
89	6	10	2	
0	19	10	1	
90	6	8	3	

7.

£.	s.	d.	qr.	
0	3	1	2	×2
			10	
1	11	3	0	
			9	
14	1	3	0	
0	6	3	0	
14	7	6	0	

8.

£.	s.	d.	qr.	
0	4	4	2	×3
			10	
2	3	9	0	
			9	
19	13	9	0	
0	13	1	2	
20	6	10	2	

9.

£.	s.	d.	qr.	
0	3	3	2	×4
			10	
1	12	11	0	
			9	
4	16	3	0	
0	13	2	0	
5	9	5	0	

10.

£.	s.	d.	qr.	
0	6	6	2	×5
			10	
3	5	5	0	
			9	
29	8	9	0	
1	12	8	2	
31	1	5	2	

11.

£.	s.	d.	qr.	
0	5	5	2	×1
			12	
3	5	6	0	
			8	
26	4	0	0	
0	5	5	2	
26	9	5	2	

12.

£.	s.	d.	qr.	
0	7	7	2	×2
			12	
4	11	6	0	
			8	
36	12	0	0	
0	15	3	0	
37	7	3	0	

4. Montreal, June 17, 1835.

Mr. Samuel Simpson,

Bought of Lackington, Grey, & Co.

				£.	s.	d.
19 yds.	Cloth,	at	1s. 6d.,	1	8	6
23 "	Worsted,	"	7s. 8¼d.,	8	16	9¾
26 "	Baize,	"	3s. 11½d.,	5	2	11
29 "	Camlet,	"	6s. 10½d.,	9	19	4½
31 "	Bombazine,	"	1s. 5¼d.,	2	4	6¾
34 "	Linen,	"	3s. 7d.,	6	1	10
37 "	Cotton,	"	11s. 9d.,	21	14	9
38 "	Flannel,	"	6s. 11d.,	13	2	10
39 "	Calico,	"	3s. 10¼d.,	7	10	3¾
41 "	Broadcloth,	"	6s. 9½d.,	13	18	5½
43 "	Nankin,	"	7s. 5¾d.,	16	1	7¼
				106£.	1s.	11½d.

OPERATION.

1. £	s.	d.		2. £	s.	d.	qr.		3. £	s.	d.	qr.		4. £	s.	d.	qr.
0	1	6	×1	0	7	8	1	×2	0	3	11	2	×1	0	6	10	2	×1
		9					7					5					7	
0	13	6		2	13	9	3		0	19	9	2		2	8	1	2	
		2					3					5					4	
1	7	0		8	1	5	1		4	18	11	2		9	12	6	0	
0	1	6		0	15	4	2		0	3	11	2		0	6	10	2	
1	8	6		8	16	9	3		5	2	11	0		9	19	4	2	

5. £	s.	d.	qr.		6. £	s.	d.		7. £	s.	d.		8. £	s.	d.	
0	1	5	1	×1	0	3	7	×4	0	11	9	×2	0	6	11	×2
			10				10				7				6	
0	14	4	2		1	15	10		4	2	3		2	1	6	
			3				3				5				6	
2	3	1	2		5	7	6		20	11	3		12	9	0	
0	1	5	1		0	14	4		1	3	6		0	13	10	
2	4	6	3		6	1	10		21	14	9		13	2	10	

9. £	s.	d.	qr.		10. £	s.	d.	qr.		11. £	s.	d.	qr.	
0	3	10	1	×3	0	6	9	2	×1	0	7	5	3	×3
			6					10					10	
1	3	1	2		3	7	11	0		3	14	9	2	
			6					4					4	
6	18	9	0		13	11	8	0		14	19	2	0	
0	11	6	3		0	6	9	2		1	2	5	1	
7	10	3	3		13	18	5	2		16	1	7	1	

5. Liverpool, June 2, 1835.

John Jones, of Philadelphia, U. S.,

Bought of Thomas Hasseltine,

			£.	s.	d.
297 yds.	Black Broadcloth,	at 17s. 3½d.,	256	15	7½
473 "	Blue do.	" 9s. 11¼d.,	235	0	5¼
512 "	Red do.	" 15s. 10d.,	405	6	8
	Amount forward,		897£.	2s.	8¾d

		£.	s.	d.
	Amount brought forward,	897	2	8¾
624 yds.	Green Broadcloth, at 12s. 8d.,	395	4	0
765 "	White do. " 19s. 9½d.,	757	0	7½
169 "	Black Velvet, " 13s. 5¼d.,	113	10	11¼
698 "	Green do. " 15s. 6¾d.,	543	2	7½
315 "	Red do. " 14s. 3½d.,	225	1	10½
713 "	White do. " 11s. 7½d.,	414	8	7½
519 "	Carpet, " 13s. 6¼d.,	350	17	3¾
147 "	Black Kerseymere, " 16s. 7¾d.,	122	6	11¼
386 "	Blue do. " 14s. 3¼d.,	275	8	6½
137 "	Green do. " 19s. 9d.,	135	5	9
999 "	Black Silk, " 15s. 8d.,	782	11	0
		5012£. 0s. 11½d.		

OPERATION.

1. £.	s.	d.	qr.	2. £.	s.	d.	qr.	3. £.	s.	d.	4. £.	s.	d.
0	17	3	2×7	0	9	11	1×3	0	15	10×2	0	12	8×4
		10				10			10			10	
8	12	11	0×9	4	19	4	2×7	7	18	4×1	6	6	8×2
		10				10			10			10	
86	9	2	0	49	13	9	0	79	3	4	63	6	8
		2				4			5			6	
172	18	4	0	198	15	0	0	395	16	8	380	0	0
77	16	3	0	34	15	7	2	7	18	4	12	13	4
6	1	0	2	1	9	9	3	1	11	8	2	10	8
256	15	7	2	235	0	5	1	405	6	8	395	4	0

5. £.	s.	d.	qr.	6. £.	s.	d.	qr.	7. £.	s.	d.	qr.
0	19	9	2×5	0	13	5	1×9	0	15	6	3×8
		10				10				10	
9	17	11	0×6	6	14	4	2×6	7	15	7	2×9
		10				10				10	
98	19	2	0	67	3	9	0	77	16	3	0
			7	40	6	3	0				6
692	14	2	0	6	0	11	1	466	17	6	0
59	7	6	0	113	10	11	1	70	0	7	2
4	18	11	2					6	4	6	0
757	0	7	2					543	2	7	2

8.

£	s.	d.	qr.	
0	14	3	2	×5
		10		
7	2	11	0	×1
		10		
71	9	2	0	
		3		
214	7	6	0	
7	2	11	0	
3	11	5	2	
225	1	10	2	

9.

£	s.	d	qr.	
0	11	7	2	×3
		10		
5	16	3	0	×1
		10		
58	2	6	0	
		7		
406	17	6	0	
5	16	3	0	
1	14	10	2	
414	8	7	2	

10.

£	s.	d.	qr	
0	13	6	1	×9
		10		
6	15	2	2	×1
		10		
67	12	1	0	
		5		
338	0	5	0	
6	15	2	2	
6	1	8	1	
350	17	3	3	

11.

£.	s.	d.	qr.	
0	16	7	3	×7
		10		
8	6	5	2	×4
		10		
83	4	7	0	
33	5	10	0	
5	16	6	1	
122	6	11	1	

12.

£.	s.	d.	qr.	
0	14	3	1	×6
		10		
7	2	8	2	×8
		10		
71	7	1	0	
			3	
214	1	3	0	
57	1	8	0	
4	5	7	2	
275	8	6	2	

13.

£.	s.	d.	
0	19	9	×7
		10	
9	17	6	×3
		10	
98	15	0	
29	12	6	
6	18	3	
135	5	9	

14.

£.	s.	d.	
0	15	8	×9
		10	
7	16	8	×9
		10	
78	6	8	
		9	
705	0	0	
70	10	0	
7	1	0	
782	11	0	

SECTION XV.

COMPOUND DIVISION.

2. (p. 85.)

	£.	s.	d.
9)	10	13	0
	1	3	8

3.

	£.	s.	d.	qr.
7)	10	0	4	2
	1	8	7	2

4.

	£.	s	d.
8)	3	2	4
	0	7	9½

5.

	yd.	qr.	na.
5)	54	2	3
	10	3	3

6.

	cwt.	qr.	lb.
9)	29	3	16
	3	1	8

7.

	T.	cwt.	qr.	lb.
5)	37	17	0	16
	7	11	1	20

8.

	d.	h.	m.	sec.
10)	76	11	53	0
	7	15	35	18

9.

	£.	s.	d.	qr.
9)	151	19	11	1
	16	17	9	1

10.

£.	s.	d.	qr.
519)350	17	3	3(0£.
20			
519)7017(13s.			
519			
1827			
1557			
270			
12			
519)3243(6d.			
3114			
129			
4			
519)519(1qr.			
519			

11.

£.	s.	d.	qr.
63)225	1	10	2(3£.
189			
36			
20			
63)721(11s.			
63			
91			
63			
28			
12			
63)346(5d.			
315			
31			
4			
63)126(2qr.			
126			

12.

£.	s.	d.	qr
12)159	4	9	0
13	5	4	3

13.

£.	s.	d.	qr.
4)75	6	6	0
18	16	7	2

14.

£.	s.	d.
7)111	8	11
15	18	5

15.

£.	s.	d.	qr.
12)159	4	9	0
13	5	4	3

16.

lb.	oz.	dwt.	gr.
9)158	9	1	21
17	7	13	13

17.

lb.	oz.	dwt.	gr.
7)111	11	17	9
15	11	19	15

18.

T.	cwt.	qr.	lb.	oz.
11)183	1	2	11	4
16	12	3	13	12

19.

T.	cwt.	qr.	lb.	oz.
8)105	7	0	6	8
13	3	1	14	13

20.

℔	ʒ	ʒ	℈	gr.
8)19	9	4	2	9
2	5	5	1	16⅛

21.

yd.	qr.	na.	in.
7)335	2	0	0½
47	3	2	2

22.

m.	fur.	rd.	ft.	in.
12)215	7	1	14	6
17	7	36	13	7

23.

deg.	m.	fur.	rd.	yd.	ft.	in.
9)149	8	0	0	1	1	6
16	39	4	0	0	0	6

The answer to No. 23 is correct. But if we subtract 1 furlong from the 4 furlongs, there will remain 3 furlongs Then, if we add its equal, 39 rods and 5½ yards, — which together are equal to 1 furlong, — to their respective denominations, we obtain another quotient equal in value to the former. But 5½ yards are 5yd. 1ft. 6in., and this we substitute for 5½ yards. The operation will be as follows: —

deg.	m.	fur.	rd.	yd.	ft.	in.
16	39	4	0	0	0	6
		1				
16	39	3	0	0	0	6
			39	5	1	6
16	39	3	39	5	2	0

Thus we perceive the value of the two answers is the same. This process we are obliged to take to obtain the answer given on page 79.

24.

deg.	m.	fur.	rd.	ft.	in.	bar.
6)97	55	7	35	4	2	1
16	20	7	12	8	11	$1\frac{1}{6}$
						6
97	$55\frac{1}{2}$	3	35	$3\frac{1}{2}$	8	1
	$\frac{1}{2}$=4			$\frac{1}{2}$=6		
97	55	7	35	4	2	1

Proof.

In this question we add the $\frac{1}{2}$ mile, = 4 furlongs, to the 3 furlongs, and the $\frac{1}{2}$ foot, = 6 inches, to the 8 inches, and we obtain a correct answer without fractions.

25.

A.	R.	p.	yd.	ft.	in.
11)181	3	11	6	4	41
16	2	4	19	7	79

26.

Cords.	ft.	in.
4)31	83	1332
7	116	1629

27.

hhd.	gal.	qt.	pt.	gl.
7)209	55	3	0	1
29	61	3	1	3

28.

Tuns.	hhd.	gal.	qt.
9)35	3	4	2
3	3	56	2

29.

hhd.	gal.	qt.	pt.
8)56	45	0	0
7	5	2	1

30.

bu.	pk.	qt.	pt.
6)118	1	5	0
19	2	7	1

31.

ch.	bu.	pk.	qt.
7)255	24	3	1
36	18	3	7

32.

y.	d.	h.	m.	sec.
8)110	343	3	41	12
13	316	15	27	39

33.

A.	R.	p.
9)214	3	12
23	3	$19\frac{1}{2}$

34.

d.	h.	m.	sec.
12)3	16	54	0
0	7	24	30

35.

bu.	pk.	qt.
8)29	0	0
3	2	4

37.

£.	s.	d.
4)2	18	8
4)0	14	8
0	3	8

38.

£.	s.	d.
9)71	14	0
8)7	19	4
0	19	11

39.

£.	s.	d.
12)8	1	0
7)0	13	5
0	1	11

40.

T.	cwt.	qr.	lb.
10)56	13	3	10
9)5	13	1	15
0	12	2	11

41.

£.	s.	d.	qr.
6)5	4	3	0
3)0	17	4	2
0	5	9	2

42.

£.	s.	d.
7)10	8	3
3)1	9	9
0	9	11

43.

£.	s.	d.
1)12	13	0
2)1	3	0
0	11	6

44.

£.	s.	d.	qr.
12)1290	4	0	0
8)107	10	4	0
13	8	9	2

45.

lb.	oz.	dwt.	gr.
12)32	9	15	0
10)2	8	16	6
0	3	5	15

46.

m.	fur.	rd.
6)746	5	0
5)124	3	20
24	7	4

47.

°	′
10)15	0
6)1	30
0	15

48.

A.	R.	p.	yd.	ft.	in.
8)1275	2	16	22	8	32
4)159	1	32	2	7	112
39	3	18	0	6	64
		1			
39	3	17	0	6	64
			30	2	36
39	3	17	30	8	100

NOTE. The first answer is correct, and the last has the same value, for 1 pole is equal to 30yd. 2ft. 36in.

49.

y.	d.	h.	m.	sec.
12)2	68	19	54	0
10)0	66	14	39	30
3)0	6	15	51	57
0	2	5	17	19

50.

£.	s.	d.	
53)1001	9	7	(18£.
53			
471			
424			
47			
20			
53)949			(17s.
53			
419			
371			
48			
12			
53)583			(11d.
53			
53			
53			

51.

£.	s.	d.	qr.	
57)23	11	5	1	(0£.
20				
57)471				(8s.
456				
15				
12				
57)185				(3d.
171				
14				
4				
57)57				(1qr.
57				

52.

A.	R.	p.	
29)3419	2	23	(117A.
29			
51			
29			
229			
203			
26			
4			
29)106			(3R.
87			
19			
40			
29)783			(27p.
58			
203			
203			

53.

yd. qr. na. in.

89)3375 3 1 0¼(37yd.
267
705
623
82
4
89)331(3qr
267
64
4
89)257(2na
178
79
2¼
158¼
19¾
89)178(2in.
178

54.

hhd. gal. qt. pt.

59)44 52 2 1(0hhd
63
134
269
59)2824(47gal.
236
464
413
51
4
59)206(3qt.
177
29
2
59)59(1pt.
59

55.

m. fur. ro. ft.

365)6357 5 14 11½(17m.
365
2707
2555
152
8
365)1221(3fur.
1095
126
40
365)5054(13rd.
365
1404
(Carried up.)

(Brought up.)
1404
1095
309
16½
1855½
310
154½
365)5110(14ft.
365
1460
1460

56. 3gal. 1qt. 1pt.
57. 37ft. 978in.
58. 7 cords 98 cubic feet.
59. 2hhd. 19gal. 0qt. 1pt.
60. 3bu. 1pk. 4qt. 1pt. 1gi.
61. 16ch. 7bu. 2pk. 0qt. 0pt.
62. 2£. 1s. $3\frac{2}{3}\frac{0}{6}$d.
63. 1£. 1s. $8\frac{5}{5}\frac{9}{7}\frac{9}{1}$d.
64. 17£. 6s. $1\frac{3}{8}\frac{9}{7}$d.
65. 4T. 15cwt. 2qr. $12\frac{3}{1}\frac{6}{4}\frac{8}{6}$lb.
66. 19m. 3fur. 39rd. 13ft. $2\frac{2}{4}\frac{8}{1}$in.
68. 9A. 1R. 19p. $139\frac{8}{8}\frac{4}{7}$ft.
69. 13A. 0R. 27p. 3yd. 0ft. $45\frac{3}{1}\frac{3}{1}$in.
70. 142£. 19s. $1\frac{3}{4}\frac{6}{7}$d.
71. 14£. 7s. $10\frac{4}{3}\frac{4}{6}$d.
72. $ 1001.34.

QUESTIONS TO BE PERFORMED BY ANALYSIS.

1. (p. 88.) $ 8.75 ÷ 7 = $ 1.25; $ 1.25 × 20 = $ 25.00 Ans
2. $ 85 ÷ 5 = $ 17; $ 17 × 17 = $ 289 Ans.
3. $ 0.75 ÷ 3 = $ 0.25; $ 0.25 × 37 = $ 9.25 Ans.
4. $ 1.92 ÷ 4 = $ 0.48; $ 0.48 × 37 = $ 17.76 Ans.
5. $ 1.08 ÷ 12 = $ 0.09; $ 0.09 × 25 = $ 2.25 Ans.
6. $ 63 ÷ 9 = $ 7; $ 7 × 27 = $ 189 Ans.
7. 20 ÷ 5 = 4; 28 ÷ 4 = 7 hours, Ans.
8. 49 ÷ 7 = 7; 7 × 19 = 133 crackers, Ans.
9. $ 20 ÷ 5 = $ 4; $ 4 × 40 = $ 160 Ans.
10. $ 0.36 ÷ 3 = $ 0.12; $ 0.12 × 37 = $ 4.44 Ans.
11. $ 0.72 ÷ 9 = $ 0.08; $ 0.08 × 37 = $ 2.96 Ans.
12. 2£. 17s. 5d. ÷ 52 = 1s. $1\frac{1}{4}$d.; 1s. $1\frac{1}{4}$d. × 76 = 4£. 3s. 11d. Ans.
13. 4£. 3s. 11d. ÷ 76 = 1s. $1\frac{1}{4}$d.; 1s. $1\frac{1}{4}$d. × 52 = 2£. 17s. 5d. Ans.
14. 2£. 17s. 5d. ÷ 52 = 1s. $1\frac{1}{4}$d.; 4£. 3s. 11d. ÷ 1s. $1\frac{1}{4}$d. = 76lb. Ans.
15. 4£. 3s. 11d. ÷ 76 = 1s. $1\frac{1}{4}$d.; 2£. 17s. 5d. ÷ 1s. $1\frac{1}{4}$d. = 52lb. Ans.
16. 8£. 3s. 11d. ÷ 20 = 8s. $2\frac{7}{2}\frac{7}{0}$d.; 8s. $2\frac{7}{2}\frac{7}{0}$d. × 200 = 81£. 19s. 2d. Ans.
17. 81£. 19s. 2d. ÷ 200 = 8s. $2\frac{7}{2}\frac{7}{0}$d.; 8s. $2\frac{7}{2}\frac{7}{0}$d. × 20 = 8£. 3s. 11d. Ans.

18. 3£. 4s. 2d. ÷ 10 = 6s. 5d.; 6s. 5d. × 97 = 31£. 2s. 5d. Ans.
19. 2£. 12s. ÷ 8 = 6s. 6d.; 6s. 6d. × 29 = 9£. 8s. 6d. Ans.
20. 6£. 13s. 2d. ÷ 17 = 7s. 10d.; 7s. 10d. × 101 = 39£ 11s. 2d. Ans.
21. 10£. 4s. 3d. ÷ 19 = 10s. 9d.; 10s. 9d. × 97 = 52£. 2s. 9d. Ans.

SECTION XVI.

VULGAR FRACTIONS.

CASE I.

2. (p. 92.)	56	7.	1	12.	1
3.	32	8.	1	13.	671
4.	57	9.	12	14.	4
5.	1	10.	15	15.	3
6.	35	11.	78		

CASE II.

2. (p. 93.)	$\frac{4}{21}$	6.	$\frac{3}{35}$	10.	$\frac{811}{1116}$
3.	$\frac{3}{4}$	7.	$\frac{81}{422}$	11.	$\frac{41}{61}$
4.	$\frac{3}{7}$	8.	$\frac{1}{7}$	12.	$\frac{408}{509}$
5.	$\frac{7}{54}$	9.	$\frac{416}{875}$	13.	$\frac{41}{152}$

CASE III.

2. (p. 94.)	$\frac{178}{11}$	10.	$\frac{69681}{97}$	17.	$\frac{8888888}{1000}$
3.	$\frac{101}{7}$	11.	$\frac{20000}{153}$	18.	$\frac{7}{1}$
4.	$\frac{4678}{37}$	12.	$\frac{55453}{116}$	19.	$\frac{11}{1}$
5.	$\frac{205282}{137}$	13.	$\frac{1010388}{116}$	20.	$\frac{1}{1}$
6.	$\frac{2577}{16}$	14.	$\frac{126388}{117}$	21.	$\frac{100}{1}$
7.	$\frac{10146}{59}$	15.	$\frac{1885292}{307}$	23.	$\frac{85}{17}$
8.	$\frac{2554}{97}$	16.	$\frac{5205582}{201}$	24.	$\frac{247}{13}$
9.	$\frac{7107}{61}$				

CASE IV.

2. (p. 95.) $11\frac{2}{15}$ | 5. $3\frac{134}{161}$ | 8. 125
3. $14\frac{7}{116}$ | 6. $111\frac{1}{3}$ | 9. 1
4. $7\frac{12}{17}$ | 7. $91\frac{28}{45}$ |

CASE V.

9 (p. 97.) $\frac{\frac{2}{7}}{\frac{3}{5}} = \frac{2}{7} \times \frac{5}{3} = \frac{10}{21}$ Ans.

10. $\frac{8}{\frac{1}{3}} = \frac{8}{1} \times \frac{3}{1} = \frac{24}{1} = 24$ Ans.

11. $\frac{\frac{4}{7}}{2} = \frac{4}{7} \times \frac{1}{2} = \frac{4}{14} = \frac{2}{7}$ Ans.

12. $\frac{5\frac{1}{3}}{\frac{3}{7}} = \frac{\frac{16}{3}}{\frac{3}{7}} = \frac{16}{3} \times \frac{7}{3} = \frac{112}{9} = 12\frac{4}{9}$ Ans.

13. $\frac{\frac{1}{4}}{6\frac{1}{2}} = \frac{\frac{1}{4}}{\frac{13}{2}} = \frac{1}{4} \times \frac{2}{13} = \frac{2}{52} = \frac{1}{26}$ Ans.

14. $\frac{3}{2\frac{1}{2}} = \frac{\frac{3}{1}}{\frac{5}{2}} = \frac{3}{1} \times \frac{2}{5} = \frac{6}{5} = 1\frac{1}{5}$ Ans.

15. $\frac{3\frac{1}{4}}{9} = \frac{\frac{13}{4}}{\frac{9}{1}} = \frac{13}{4} \times \frac{1}{9} = \frac{13}{36}$ Ans.

16. $\frac{11\frac{2}{3}}{12\frac{3}{5}} = \frac{\frac{35}{3}}{\frac{63}{5}} = \frac{35}{3} \times \frac{5}{63} = \frac{175}{189} = \frac{25}{27}$ Ans.

17. $\frac{\frac{77}{9}}{\frac{11\frac{4}{5}}{7}} = \frac{\frac{70}{9}}{\frac{59}{5}} = \frac{70}{9} \times \frac{5}{59} \times \frac{1}{7} = \frac{350}{3717} = \frac{50}{531}$ Ans.

CASE VI.

2. (p. 97.) $\frac{770}{1728} = \frac{385}{864}$.
3. $\frac{198}{9450} = \frac{11}{525}$.
4. $\frac{660}{5824} = \frac{165}{1456}$.
5. $\frac{756}{308} = 2\frac{5}{11}$.
6. $\frac{506780}{880} = 575\frac{18}{44}$.

CASE VII.

3. (p. 101.) 360 | 5. 3600 | 7. 27600
4. 798 | 6. 6300 | 8. 60 quarts.

CASE VIII.

3. (p. 104.) $\frac{720}{1320}$, $\frac{704}{1320}$, $\frac{1254}{1320}$, $\frac{275}{1320}$.
4. $\frac{12}{84}$, $\frac{18}{84}$, $\frac{32}{84}$, $\frac{15}{84}$.
5. $\frac{22}{42}$, $\frac{24}{42}$, $\frac{33}{42}$, $\frac{21}{42}$.
6. $\frac{210}{308}$, $\frac{84}{308}$, $\frac{176}{308}$, $\frac{231}{308}$.
7. $\frac{30}{60}$, $\frac{40}{60}$, $\frac{45}{60}$, $\frac{48}{60}$.
8. $\frac{594}{693}$, $\frac{308}{693}$, $\frac{315}{693}$, $\frac{441}{693}$.
9. $\frac{80}{120}$, $\frac{105}{120}$, $\frac{20}{120}$, $\frac{456}{120}$.
10. $\frac{70}{168}$, $\frac{63}{168}$, $\frac{96}{168}$, $\frac{798}{168}$.
11. $\frac{24}{42}$, $\frac{15}{42}$, $\frac{22}{42}$, $\frac{21}{42}$.
12. $\frac{224}{252}$, $\frac{147}{252}$, $\frac{238}{252}$, $\frac{24}{252}$.
13. $\frac{570}{600}$, $\frac{140}{600}$, $\frac{165}{600}$, $\frac{12}{600}$.
14. $\frac{210}{240}$, $\frac{140}{240}$, $\frac{105}{240}$, $\frac{84}{240}$.
15. $\frac{14}{63}$, $\frac{441}{63}$, $\frac{504}{63}$, $\frac{324}{63}$.
17. $\frac{360}{630}$, $\frac{560}{630}$, $\frac{189}{630}$.
18. $\frac{546}{1001}$, $\frac{572}{1001}$, $\frac{616}{1001}$.
19. $\frac{364}{624}$, $\frac{192}{624}$, $\frac{4836}{624}$.
20. $\frac{1485}{2295}$, $\frac{1020}{2295}$, $\frac{612}{2295}$.
21. $\frac{2040}{2295}$, $\frac{540}{2295}$, $\frac{26316}{2295}$.
22. $\frac{21}{42}$, $\frac{28}{42}$, $\frac{24}{42}$, $\frac{336}{42}$.
23. $\frac{528}{1188}$, $\frac{756}{1188}$, $\frac{6039}{1188}$.
24. $\frac{24}{48}$, $\frac{36}{48}$, $\frac{8}{48}$, $\frac{816}{48}$.
25. $\frac{110}{120}$, $\frac{576}{120}$, $\frac{2580}{120}$.
26. $\frac{12012}{14014}$, $\frac{5096}{14014}$, $\frac{5390}{14014}$, $\frac{8008}{14014}$, $\frac{7007}{14014}$.
27. $\frac{285068816}{1784315\,52}$, $\frac{37088064}{1784315\,52}$, $\frac{722813}{1784315\,52}$.

OPERATION.

28. $$\frac{4}{6\frac{2}{3}} = \frac{4}{\frac{20}{3}} = \frac{\overset{1}{\cancel{4}}}{1} \times \frac{3}{\underset{5}{\cancel{20}}} = \frac{3}{5}.$$

$$\frac{7\frac{1}{2}}{9} = \frac{\frac{15}{2}}{\frac{9}{1}} = \frac{\overset{5}{\cancel{15}}}{2} \times \frac{1}{\underset{3}{\cancel{9}}} = \frac{5}{6}.$$

$$\frac{3\frac{3}{4}}{11\frac{1}{4}} = \frac{\frac{15}{4}}{\frac{45}{4}} = \frac{\overset{1}{\cancel{15}}}{\cancel{4}} \times \frac{\cancel{4}}{\underset{3}{\cancel{45}}} = \frac{1}{3}.$$

s) $\frac{2}{5}$, $\frac{5}{6}$, $\frac{1}{3}$

5, 2, 3

$3 \times 5 \times 2 \times 3 = 90$

90

5 | $18 \times 3 = 54$

6 | $15 \times 5 = 75$

3 | $20 \times 1 = 20$

$\frac{44}{90}$, $\frac{75}{90}$, $\frac{20}{90}$, Ans.

OPERATION.

29. $\frac{\frac{3}{8}}{11\frac{1}{4}} = \frac{\frac{3}{8}}{\frac{45}{4}} = \frac{\overset{1}{\cancel{3}}}{\cancel{8}} \times \frac{\cancel{4}}{\underset{15}{\cancel{45}}} = \frac{1}{30}$.

$\frac{6\frac{1}{3}}{31\frac{2}{3}} = \frac{\frac{19}{3}}{\frac{95}{3}} = \frac{\overset{1}{\cancel{19}}}{\cancel{3}} \times \frac{\cancel{3}}{\underset{5}{\cancel{95}}} = \frac{1}{5}$.

$\frac{29\frac{1}{7}}{65\frac{1}{7}} = \frac{\frac{204}{7}}{\frac{459}{7}} = \frac{\overset{4}{\cancel{204}}}{\cancel{7}} \times \frac{\cancel{7}}{\underset{9}{\cancel{459}}} = \frac{4}{9}$.

$3\overline{)\overset{1}{\cancel{30}}, \overset{1}{\cancel{5}}, \frac{4}{9}}$ — $\overline{10 \qquad 3}$

30	$3 \times 1 = 3$
5	$18 \times 1 = 18$
9	$10 \times 4 = 40$

$3 \times 10 \times 3 = 90$

$\frac{3}{90}, \frac{18}{90}, \frac{40}{90}$, Ans.

OPERATION.

30. $16 = \frac{16}{1}$. $\frac{8\frac{4}{5}}{11\frac{7}{10}} = \frac{\frac{44}{5}}{\frac{117}{10}} = \frac{44}{\cancel{5}} \times \frac{\overset{2}{\cancel{10}}}{117} = \frac{88}{117}$.

$\frac{88}{117} \times \frac{2}{7} = \frac{176}{819}$. $8\frac{2}{5} \times \frac{3}{5} = \frac{74}{\cancel{9}} \times \frac{\overset{1}{\cancel{3}}}{5} = \frac{74}{15}$.

$3\overline{)\frac{16}{1}, \frac{176}{819}, \frac{74}{15}}$ — $\overline{1, \ 273, \ 5}$

1	$4095 \times 16 = 65520$
819	$5 \times 176 = 880$
15	$273 \times 74 = 20202$

$3 \times 273 \times 5 = 4095$

$\frac{65520}{4095}, \frac{880}{4095}, \frac{20202}{4095}$, Ans.

32. $\frac{252}{14}$. | 33. $\frac{1800}{18}$. | 34. $\frac{471}{3}$.

CASE IX.

2. (p. 105.) $\frac{\cancel{4}}{5} \times \frac{1}{\cancel{4}} \times \frac{1}{12} \times \frac{1}{20} = \frac{1}{1200}$ Ans.

3. $\frac{2}{5} \times \frac{1}{24} \times \frac{1}{20} \times \frac{1}{12} = \frac{2}{2880} = \frac{1}{1440}$ Ans.

4. $\frac{5}{9} \times \frac{1}{3} \times \frac{1}{8} \times \frac{1}{12} = \frac{5}{2592}$ Ans.

5. $\frac{\overset{3}{\cancel{6}}}{11} \times \frac{1}{16} \times \frac{1}{28} \times \frac{1}{\underset{2}{\cancel{4}}} = \frac{3}{9856}$ Ans.

6. $\frac{3}{4} \times \frac{1}{28} \times \frac{1}{4} \times \frac{1}{20} = \frac{3}{8960}$ Ans.

7. $\frac{1}{5} \times \frac{1}{21\frac{1}{4}} \times \frac{1}{4} \times \frac{1}{5} = \frac{1}{2125}$ Ans.

8. $\frac{\cancel{4}}{7} \times \frac{1}{12} \times \frac{1}{16\frac{1}{2}} \times \frac{1}{40} \times \frac{1}{\underset{2}{\cancel{8}}} = \frac{1}{110880}$ Ans.

9. $\frac{1}{2} \times \frac{1}{3} \times \frac{1}{12} \times \frac{1}{16\frac{1}{2}} \times \frac{1}{40} \times \frac{1}{8} \times \frac{1}{3} = \frac{1}{1140480}$ Ans.

10. $\frac{3}{4} \times \frac{1}{144} \times \frac{1}{272\frac{1}{2}} \times \frac{1}{40} \times \frac{1}{4} = \frac{3}{2509056}$ Ans.

11. $\frac{\cancel{7}}{8} \times \frac{1}{4} \times \frac{1}{\underset{9}{\cancel{63}}} \times \frac{1}{4} = \frac{1}{1152}$ Ans.

12. $\frac{2}{5} \times \frac{1}{2} \times \frac{1}{8} \times \frac{1}{4} = \frac{2}{320}$ Ans.

13. $\frac{1}{8} \times \frac{1}{60} \times \frac{1}{24} \times \frac{1}{365\frac{1}{4}} = \frac{1}{4207680}$ Ans.

CASE X.

2. (p. 106.) $\frac{1}{1200} \times \frac{20}{1} \times \frac{12}{1} \times \frac{4}{1} = \frac{960}{1200} = \frac{4}{5}$ Ans.

3. $\frac{1}{960} \times \frac{12}{1} \times \frac{20}{1} \times \frac{24}{1} = \frac{576}{960} = \frac{3}{5}$ Ans.

4. $\frac{5}{2592} \times \frac{12}{1} \times \frac{8}{1} \times \frac{3}{1} = \frac{1440}{2592} = \frac{5}{9}$ Ans.

5. $\frac{3}{9856} \times \frac{4}{1} \times \frac{28}{1} \times \frac{16}{1} = \frac{5376}{9856} = \frac{6}{11}$ Ans.

6. $\frac{3}{89600} \times \frac{20}{1} \times \frac{4}{1} \times \frac{28}{1} = \frac{67200}{89600} = \frac{3}{4}$ Ans.

7. $\frac{1}{225} \times \frac{5}{1} \times \frac{4}{1} \times \frac{9\frac{1}{2}}{1} = \frac{45}{225} = \frac{1}{5}$ Ans.

8. $\frac{1}{110880} \times \frac{8}{1} \times \frac{40}{1} \times \frac{16\frac{1}{2}}{1} \times \frac{12}{1} = \frac{63360}{110880} = \frac{4}{7}$ Ans.

9. $\frac{1}{1140480} \times \frac{3}{1} \times \frac{8}{1} \times \frac{40}{1} \times \frac{16\frac{1}{2}}{1} \times \frac{12}{1} \times \frac{3}{1} = \frac{570240}{1140480} = \frac{1}{2}$ Ans.

10. $\frac{8}{2509805600} \times \frac{4}{1} \times \frac{40}{1} \times \frac{2721\frac{1}{2}}{1} \times \frac{144}{1} = \frac{1881179200}{2509805600} = \frac{3}{4}$ Ans.

11. $\frac{1}{1152} \times \frac{4}{1} \times \frac{63}{1} \times \frac{4}{1} = \frac{1008}{1152} = \frac{7}{8}$ Ans.

12. $\frac{3}{320} \times \frac{4}{1} \times \frac{8}{1} \times \frac{2}{1} = \frac{192}{320} = \frac{3}{5}$ Ans.

13. $\frac{1}{42076800} \times \frac{365\frac{1}{4}}{1} \times \frac{24}{1} \times \frac{60}{1} = \frac{52596000}{42076800} = \frac{1}{8}$ Ans.

CASE XI.

2. (p. 108.)

s.	d.
1	0
	7

24)7 0

Ans. $3\frac{1}{2}$

3.

s.	d.	qr.
28	0	0
		7

9)196 0 0

Ans. 21 9 $1\frac{1}{8}$

4.

cwt.	qr.	lb.	oz.	dr.
1	0	0	0	0
				7

11)7 0 0 0 0

Ans. 2 15 4 $5\frac{9}{11}$

5.

lb.	oz.	dr.
1	0	0
		4

9)4 0 0

Ans. 7 $1\frac{7}{9}$

6.

lb.	oz.	dwt.	gr.
1	0	0	0
			8

9)8 0 0 0

Ans. 10 13 8

7.

lb.	℥.	ʒ.	℈.	gr.
1	0	0	0	0
				4

13)4 0 0 0 0

Ans. 3 5 1 $12\frac{4}{13}$

8.

yd.	qr.	na.	in.
1	0	0	0
			7
13) 7	0	0	0
Ans. 2	0	1	$\frac{8}{13}$

9.

EE.	qr.	na.	in.
1	0	0	0
			5
9) 5	0	0	0
Ans. 2	3	0	$\frac{1}{4}$

10.

m.	fur.	rd.	ft.	in.
1	0	0	0	0
				11
13) 11	0	0	0	0
Ans. 6	30	12	8	$\frac{4}{13}$

11.

fur.	rd.	ft.	in.
1	0	0	0
			8
9) 8	0	0	0
Ans. 35	9	2	

12.

A.	R.	p.	yd.	ft.	in.
1	0	0	0	0	0
					7
13) 7	0	0	0	0	0
Ans. 2	6	4	5	12	$\frac{7}{13}$

13.

p.	ft.	in.
1	0	0
		9
17) 9	0	0
Ans. 144	19	$\frac{1}{17}$

14.

cord.	ft.	in
1	0	0
		1
13) 1	0	0
Ans. 9	146	$\frac{2}{13}$

15.

hhd.	gal.	qt.	pt.	gl.
1	0	0	0	0
				2
19) 2	0	0	0	0
Ans. 6	2	1	0	$\frac{4}{19}$

16.

hhd.	gal.
1	0
	7
9) 7	0
Ans. 42	

17.

year.	da.	h.	m.	sec.
1	0	0	0	0
				11
23) 11	0	0	0	0
Ans. 174	16	26	5	$\frac{5}{23}$

18. $\$7\frac{3\frac{3}{11}}{4\frac{2}{5}} = \$7\frac{\frac{36}{11}}{\frac{22}{5}}$; $\frac{36}{11} \times \frac{5}{22} = \frac{180}{232}$; $\$7\frac{180}{232}$.

To find the value of $\frac{180}{232}$ of a dollar, we multiply the numerator, 180, by 100, and divide the product by 232; thus, 180 $\times$ 100 = 18000; 18000 $\div$ 232 = $74\frac{46}{121}$. The answer, therefore, will be $\$7.74\frac{46}{121}$.

CASE XII.

7. (p. 109.) 1s. = 48qr.; $3\frac{1}{2}$d. = 14qr.; $\frac{14}{48} = \frac{7}{24}$ Ans.

8. $21 \times 12 + 9 = 261 \times 4 + 1 = 1045 \times 3 + 1 = \overline{3136} = \frac{7}{9}$ Ans.
$28 \times 12 \times 4 \times 3 = \overline{4032}$

9. $2 \times 28 + 15 = 71 \times 16 + 4 = 1140 \times 16 + 5 = 18245 \times 11 + 9 = \overline{200704}$
$4 \times 28 \times 16 \times 16 \times 11 = \overline{315392}$
$= \frac{7}{11}$ Ans.

10. $7 \times 16 + 1 = 113 \times 9 + 7 = \overline{1024} = \frac{4}{9}$ Ans.
$16 \times 16 \times 9 = \overline{2304}$

11. $10 \times 20 + 13 = 213 \times 24 + 8 = \overline{5120} = \frac{8}{9}$ Ans.
$12 \times 20 \times 24 = \overline{5760}$

12. $3 \times 8 + 5 = 29 \times 3 + 1 = 88 \times 20 + 12 = 1772 \times 13 + 4 = \overline{23040} = \frac{4}{13}$ Ans.
$12 \times 8 \times 3 \times 20 \times 13 = \overline{74880}$

13. $2 \times 4 = 8 \times 2\frac{1}{4} + 1 = 19 \times 13 + 5 = \overline{252} = \frac{7}{13}$ Ans.
$4 \times 4 \times 2\frac{1}{4} \times 13 = \overline{468}$

14. $2 \times 4 + 3 = 11 \times 2\frac{1}{2} = 24\frac{1}{2} \times 4 + 1 = \overline{100} = \frac{5}{9}$ Ans.
$5 \times 4 \times 2\frac{1}{2} \times 4 = \overline{180}$

15. $\left.\begin{matrix} 6 \times 40 + 30 = 270 \times 16\frac{1}{2} + 12 = 4467 \times 12 + 8 \\ = 53612 \times 3 = 160836 \times 13 + 12 \end{matrix}\right\} = \overline{2090880} = \frac{11}{13}$ Ans.
$8 \times 40 \times 16\frac{1}{2} \times 12 \times 3 \times 13 = \overline{9471040}$

16. $35 \times 16\frac{1}{2} + 9 = 586\frac{1}{2} \times 12 + 2 = \overline{7040} = \frac{8}{9}$ Ans.
$40 \times 16\frac{1}{2} \times 12 = \overline{7920}$

17. $\left.\begin{matrix} 2 \times 40 + 6 = 86 \times 30\frac{1}{4} + 4 = 2605\frac{1}{2} \times 9 + 5 = \\ 23454\frac{1}{2} \times 144 + 127 = 3377575 \times 13 + 5 \end{matrix}\right\} = \overline{43906480} = \frac{7}{13}$ Ans.
$4 \times 40 \times 30\frac{1}{4} \times 9 \times 144 \times 13 = \overline{81544320}$

18. $144 \times 144 + 19 = 20755 \times 17 + 1 = \overline{352836} = \frac{2}{17}$ Ans.
$272\frac{1}{4} \times 144 \times 17 = \overline{666468}$

19. $9 \times 1728 + 1462 = 17014 \times 13 + 2 = \overline{221184} = \frac{1}{13}$ Ans.
$128 \times 1728 \times 13 = \overline{2985392}$

20. $6 \times 4 + 2 = 26 \times 2 + 1 = 53 \times 4 = 212 \times 19 + 4 = \overline{4032} = \frac{2}{19}$ Ans
$63 \times 4 \times 2 \times 4 \times 19 = \overline{38304}$

21. $\frac{42}{63} = \frac{7}{9}$ Ans.

22. $174 \times 24 + 16 = 4192 \times 60 + 26 = 251546 \times 60 + 5 = 15092765 \times 23 + 5 = \overline{347133600}$
$365\frac{1}{4} \times 24 \times 60 \times 60 \times 23 = \overline{725894400}$
$= \frac{11}{23}$ Ans.

SECTION XVII.

ADDITION OF VULGAR FRACTIONS.

CASE I.

6. (p. 110.) $3\frac{19}{17}$.
7. $2\frac{19}{23}$.
8. $2\frac{2}{87}$.
9. $12\frac{8}{9}$.
10. $24\frac{26}{631}$.
11. $33\frac{367}{781}$.
12. $14\frac{2}{45}\frac{1}{51}$.
13. $2\frac{147}{168}$.
14. $2\frac{83}{125}$.

CASE II.

2. (p. 111.) $24\frac{3}{72}$.
3. $12\frac{21}{264}$.
4. $21\frac{33}{360}$.
5. 1.
6. $3\frac{18}{60}$.
7. $1\frac{83}{140}$.
8. $6\frac{348}{504}$.
9. $92\frac{1}{22}$.
10. $6\frac{1}{3}$.
11. $17\frac{1}{20}$.
12. $9\frac{115}{252}$.
13. $18\frac{211}{360}$.
15. $54\frac{208}{252}$.
16. 96.
17. $66\frac{17}{18}$.
18. $45\frac{1}{126}$.
19. $40\frac{4}{15}$.
20. $106\frac{37}{60}$.
21. $12\frac{891}{693}$.
22. $13\frac{31}{44}$.
23. $93\frac{3}{7}$.

24. $28\frac{36}{47}=28\frac{27}{30}$; $\frac{27}{30}=\frac{\overset{9}{\cancel{27}}}{\cancel{7}}\times\frac{7}{\underset{10}{\cancel{30}}}=\frac{9}{10}$.

$28\frac{9}{10}=28\frac{18}{20}$; $\frac{1}{8}\times\frac{2}{7}\times\frac{28}{20}=\frac{56}{210}=2\frac{14}{210}$.

$3\frac{391}{105}=3\frac{\frac{79}{2}}{\frac{105}{1}}$; $\frac{79}{2}\times\frac{1}{105}=\frac{79}{210}$; $3\frac{79}{210}$.

$2\frac{14}{210}+3\frac{79}{210}=6\frac{9}{70}$ Ans.

25. $\frac{1}{8}=\frac{1}{8}$; $2\frac{5}{8}=\frac{21}{8}$; $\frac{45}{94\frac{7}{11}}=\frac{\frac{45}{1}}{\frac{1041}{11}}=\frac{45}{1}\times\frac{11}{1041}=\frac{495}{1041}$

$\frac{475}{3143}=\frac{\frac{428}{8}}{\frac{1572}{5}}=\frac{428}{8}\times\frac{5}{1573}=\frac{2140}{14157}$.

$\frac{1}{8}+\frac{21}{8}+\frac{495}{1041}+\frac{2140}{14157}$.

3)$\cancel{9}$, 8, 1041, 14157

8, 347, 4719

$3\times 8\times 347\times 4719=39299832$

39299832

9	4366648	× 1 =	4366648	
8	4912479	× 21 =	103162059	
1041	37752	× 495 =	18687240	
14157	2776	× 2140 =	5940640	.
			132156587	

$$\frac{132156587}{39299832} = 3\tfrac{14257081}{39299832} \text{ Ans.}$$

CASE IV.

3. (p. 114.)

	cwt.	qr.	lb.
$\frac{7}{11}$ of a ton =	12	2	$25\frac{5}{11}$
$\frac{17}{22}$ of a cwt. =		3	$2\frac{6}{11}$
Ans.	13	2	0

4.

	qr.	na.	in.
$\frac{3}{5}$ of a yd. =	2	1	$1\frac{7}{20}$
$\frac{1}{4}$ of an E.E. =		2	$1\frac{3}{4}$
$\frac{6}{7}$ of a qr. =		3	$0\frac{37}{28}$
Ans.	3	3	$1\frac{38}{140}$

5.

	fur.	rd.	ft.	in.	bar.
$\frac{7}{11}$ of a mile =	5	3	10	6	0
$\frac{4}{13}$ of a furlong =		12	5	0	$2\frac{10}{13}$
$\frac{9}{22}$ of a yard =			1	2	$2\frac{2}{11}$
	5	15	16	9	$1\frac{38}{143}$ =
Ans.	5	16	0	3	$1\frac{38}{143}$.

6.

	A.	R.	p.	ft.	in.
$\frac{5}{7}$ of an A. =	0	2	34	77	$113\frac{1}{7}$
$\frac{2}{3}$ of an A. =	0	2	26	181	72
$\frac{13}{14}$ of an A. =	0	3	28	155	$82\frac{3}{7}$
	2	1	9	$141\frac{3}{4}$	$123\frac{3}{7}$ =
Ans.	2	1	9	142	$87\frac{3}{7}$

7.

	m.	fur.	rd.	ft.	in.
$18\frac{3}{7}$ miles =	18	3	17	2	$4\frac{2}{7}$
$23\frac{11}{14}$ miles =	23	6	11	7	$0\frac{6}{7}$
$19\frac{1}{21}$ miles =	19	0	15	3	$11\frac{1}{7}$
Ans.	61	2	3	13	$4\frac{2}{7}$

8.

	gal.	qt.	pt.	gl.
$\frac{1}{12}$ of a gal. =	0	3	1	$1\frac{1}{3}$
$\frac{1}{12}$ of a hhd. =	5	1	0	0
Ans.	6	0	1	$1\frac{1}{3}$

9.

	d.	h.	m.
$\frac{5}{16}$ of a week =	2	4	30
$\frac{1}{5}$ of a day =		4	48
Ans.	2	9	18

10.

	ft.	in.
$\frac{3}{4}$ of a square ft. =	0	108
$\frac{1}{2}$ a foot square =		36
Ans.	1	0

11.

	rd.	ft.	in.
	11	16	5
			6
	11	16	11 =
Ans.	12	0	5

SECTION XVIII.

SUBTRACTION OF VULGAR FRACTIONS.

CASE I.

6. (p. 115.) $\frac{7}{17}$.
7. $\frac{9}{19}$.
8. $\frac{13}{37}$.
9. $\frac{2}{39}$.
10. $\frac{5}{29}$.
11. $\frac{15}{37}$.
12. $\frac{14}{31}$.
13. $\frac{3}{137}$.
14. $\frac{1}{4}$.
15. $\frac{1}{4}$.
16. $\frac{5}{36}$.
17. $\frac{7}{40}$.
18. $\frac{269}{1728}$.
19. $\frac{13}{260}$.

CASE II.

5. (p. 116.) $\frac{13}{36}$.
6. $\frac{37}{72}$.
7. $\frac{1}{2}$.
8. $\frac{19}{34}$.
9. $\frac{17}{60}$.
10. $\frac{124}{823}$.
11. $\frac{627}{7227}$.
12. $\frac{982}{2331}$.
13. $\frac{8}{25}$.
14. $\frac{33}{100}$.
15. $\frac{5}{54}$.
16. $\frac{3}{56}$.
17. $1\frac{9}{28}$.
18. $1\frac{11}{12}$.
19. $\frac{1}{12}$.

CASE III.

8. (p. 117.) $54\frac{4}{7}$.
9. $184\frac{4}{7}$.
10. $78\frac{3}{23}$.
11. $680\frac{4}{19}$.
12. $30\frac{1}{5}$.
13. $31\frac{6}{19}$.

16.
$18\frac{3}{8} = 18\frac{27}{72}$
$9\frac{5}{9} = 9\frac{40}{72}$
$8\frac{35}{72}$ Ans.

17.
$73\frac{4}{5} = 73\frac{48}{60}$
$16\frac{11}{12} = 16\frac{55}{60}$
$56\frac{53}{60}$ Ans.

18.
$67\frac{1}{3} = 67\frac{3}{9}$
$16\frac{2}{3} = 16\frac{6}{9}$
$50\frac{2}{3}$ Ans

19.
$29\frac{18}{19} = 29\frac{162}{171}$
$15\frac{4}{9} = 15\frac{76}{171}$
$14\frac{86}{171}$ Ans.

20.
$144\frac{3}{4} = 144\frac{39}{52}$
$99\frac{11}{13} = 99\frac{44}{52}$
$44\frac{47}{52}$ Ans.

21.
$171\frac{11}{22} = 171\frac{110}{220}$
$91\frac{9}{10} = 91\frac{198}{220}$
$79\frac{43}{55}$ Ans

22.
$101\frac{7}{8} = 101\frac{35}{40}$
$93\frac{4}{5} = 93\frac{32}{40}$
$8\frac{3}{40}$ Ans.

23.
$165\frac{1}{2} = 165\frac{8}{16}$
$98\frac{7}{8} = 98\frac{14}{16}$
$66\frac{5}{8}$ Ans.

24.
$77\frac{11}{12} = 77\frac{220}{240}$
$19\frac{19}{20} = 19\frac{228}{240}$
$57\frac{233}{240}$ Ans.

25.
$84\frac{23}{24} = 84\frac{276}{288}$
$15\frac{11}{12} = 15\frac{264}{288}$
$69\frac{12}{288}$ Ans.

26.
$671\frac{111}{721} = 671\frac{82213}{598843}$
$183\frac{69}{83} = 183\frac{82748}{598843}$
$487\frac{18307}{598843}$ Ans.

27.
$17\frac{123}{457} = 17\frac{874453}{3249927}$
$8\frac{234}{711} = 8\frac{1068838}{3249927}$
Ans. $8\frac{3054412}{3249927}$

28.
63
$7\frac{8}{11}$
$55\frac{3}{11}$ Ans.

29.
30
$5\frac{7}{12}$
$24\frac{5}{12}$ Ans.

30.
$17\frac{5}{8} = 17\frac{80}{88}$
$28\frac{7}{12} = 28\frac{56}{88}$
$46\frac{30}{88}$

144
$46\frac{30}{88}$
$97\frac{19}{22}$ Ans

31.
34
$9\frac{7}{8}$
$24\frac{1}{8}$ Ans.

32.
$\frac{2}{17} \times \frac{40}{1} = \frac{80}{17} = 4\frac{12}{17}$
$\frac{2}{11} \times \frac{40}{1} = \frac{80}{11} = 7\frac{3}{11}$
$11\frac{183}{187}$

40
$11\frac{183}{187}$
$28\frac{4}{187}$ Ans.

33.
$\frac{1}{4} \times \frac{8}{1} = \frac{8}{4} = 2\frac{1}{4}$ feet.
$\frac{1}{6} \times \frac{1}{6} = \frac{1}{36}$; $\frac{1}{36} \times \frac{9}{1} = \frac{9}{36} = \frac{1}{4}$ foot.
$2\frac{1}{4} - \frac{1}{4} = 2$ feet, Ans.

NOTE. A square yard is 9 square feet; and $\frac{1}{4}$ of 9 feet is $2\frac{1}{4}$ feet. $\frac{1}{6}$ of a yard in length is 6 inches, and the square of 6 inches is 36 inches. 36 inches are $\frac{1}{4}$ of a square foot. Thus, $\frac{36}{144} = \frac{1}{4}$ foot. This fourth we subtract from $2\frac{1}{4}$ feet. Thus, $2\frac{1}{4} - \frac{1}{4} = 2$ feet, Ans.

34.
$\frac{49\frac{5}{8}}{97} = \frac{\frac{397}{8}}{\frac{97}{1}} = \frac{397}{8} \times \frac{1}{97} = \frac{397}{776}$.
$\frac{343}{145\frac{8}{11}} = \frac{\frac{173}{5}}{\frac{1598}{11}} = \frac{173}{5} \times \frac{11}{1598} = \frac{1903}{7990}$.
$\frac{397}{776} - \frac{1903}{7990} = \frac{847851}{3100020}$ Ans.

CASE V.

3. (p. 120.)

	qr.	na.	in.
$\frac{7}{8}$ E.E.	= 4	1	$1\frac{1}{8}$
$\frac{3}{7}$ of a yd.	= 1	0	$1\frac{2}{7}$
Ans.	3	0	$2\frac{5}{56}$

4.

	fur.	rd.	ft.	in.
$\frac{3}{8}$ of a mile	= 1	31	1	10
$\frac{7}{11}$ of a fur.	=	25	7	6
	1	5	$10\frac{1}{2}$	4 =
Ans.	1	5	10	10

5.

	m.	fur.	rd.	ft.	in.	bar.
$\frac{5}{7}$ deg. =	49	5	5	11	9	$1\frac{2}{7}$
$\frac{3}{5}$ mile =		4	32	0	0	0
Ans.	49	0	13	11	9	$1\frac{2}{7}$

6.

	R.	p.	yd.	ft.	in.
$\frac{4}{11}$A. =	1	18	5	4	72
$\frac{3}{5}$ rod =	0	0	13	4	0
	1	17	$22\frac{1}{4}$	0	72
			$\frac{1}{4}$ =	2	36
Ans.	1	17	22	2	108

7.

	ft.	in.
$\frac{9}{10}$ cord =	115	$345\frac{3}{5}$
$\frac{2}{11}$ cord =	23	$471\frac{3}{11}$
Ans.	91	$1602\frac{18}{55}$

8

	gal.	qt.	pt.	gi.
$\frac{7}{13}$hhd. =	33	3	1	$1\frac{7}{13}$
$\frac{4}{5}$ of $\frac{7}{13}$hhd. =	27	0	1	$0\frac{28}{65}$
Ans.	6	3	0	$1\frac{7}{65}$

9.

	m.	fur.	rd.	ft.	in.	bar.
72m. =	72	0	0	0	0	0
$\frac{4}{7}$ of 72m. =	41	1	5	11	9	$1\frac{2}{7}$
	30	6	34	$4\frac{1}{2}$	2	$1\frac{5}{7}$
				$\frac{1}{2}$ =	6	0
Ans.	30	6	34	4	8	$1\frac{5}{7}$

10.

	d	h.	m.	sec.
$\frac{2}{7}$ year =	104	8	34	$17\frac{1}{7}$
$\frac{4}{5}$ week =	3	2	40	0
Ans.	101	5	54	$17\frac{1}{7}$

11.

	R.	p.	yd.	ft.	in.
$\frac{4}{11}$A. =	1	18	5	4	72
$\frac{1}{2}$ft. =					72
Ans.	1	18	5	4	0

SECTION XIX.

MULTIPLICATION OF VULGAR FRACTIONS.

CASE I.

2. (p. 121.) $\frac{8}{33}$. | 4. $\frac{24}{55}$. | 6. $\frac{33}{77}$.

3. $\frac{57}{140}$. | 5. $\frac{77}{192}$. | 7. $\frac{45}{64}$.

8. $\frac{44}{11}$. | 12. $\frac{8}{15}$. | 14. $\frac{7}{11}$.
10. $\frac{1}{2}$. | 13. $\frac{2}{13}$. | 15. $\frac{1}{100}$.
11. $\frac{3}{5}$.

CASE II.

2. (p. 122.) $8\frac{4}{7}$. | 7. $12\frac{3}{5}$. | 13. $3\frac{5}{24}$.
3. $8\frac{2}{11}$. | 8. $7\frac{3}{7}$. | 14. $\$\ 9\frac{11}{12}$.
4. $4\frac{8}{9}$. | 9. $2\frac{10}{13}$. | 15. $\$\ 16\frac{13}{20}$.
5. $3\frac{3}{7}$. | 10. $6\frac{2}{7}$. | 16. $\$\ 35$.
6. $16\frac{8}{9}$. | 12. $12\frac{1}{2}$.

CASE III.

2. (p. 123.) $60\frac{1}{2}$. | 16. $\$\ 40.18\frac{18}{11\,12}$. | 30. $8\frac{4}{7}$.
3. $75\frac{3}{7}$. | 17. $\$\ 2.78\frac{4}{5}$. | 31. $8\frac{2}{11}$.
4. $82\frac{4}{5}$. | 18. $\$\ 1.91\frac{5}{8}$. | 32. $\frac{7}{22}$.
5. $108\frac{9}{11}$. | 19. $\$\ 343.73\frac{1}{8}$. | 33. $39\frac{18}{63}$.
6. $131\frac{3}{4}$. | 20. $\$\ 140.56$. | 34. $49\frac{133}{152}$.
7. $257\frac{3}{5}$. | 22. $3136\frac{33}{70}$. | 35. $26\frac{8}{35}$.
8. $709\frac{1}{11}$. | 23. $3\frac{3}{4}$. | 36. $25\frac{17}{245}$.
9. $679\frac{1}{2}$. | 24. $15\frac{6}{11}$. | 37. $299\frac{1}{21}$.
10. 16294. | 25. $63\frac{37}{45}$. | 38. $\frac{280}{2079}$.
11. $\$\ 1.91$. | 26. $78\frac{5}{8}$. | 39. $\$\ 39\frac{11}{64}$.
12. $\$\ 1.88\frac{1}{4}$. | 27. $403\frac{1}{5}$. | 40. $\$\ 256\frac{84}{77}$.
13. $\$\ 32.94\frac{3}{5}$. | 28. $26\frac{1}{4}$. | 41. $\$\ 11\frac{3}{32}$.
14. $\$\ 79.00$. | 29. $6\frac{3}{5}$. | 42. $\$\ 3\frac{33}{224}$
15. $\$\ 1703.56\frac{1}{4}$.

43.

$$\frac{27}{37\frac{1}{5}} = \frac{27}{\frac{186}{5}} = \frac{\overset{1}{\cancel{27}}}{1} \times \frac{5}{\underset{7}{\cancel{185}}} = \frac{5}{7}.$$

$$\frac{87\frac{3}{5}}{98\frac{1}{5}} = \frac{\frac{438}{5}}{\frac{491}{5}} = \frac{\cancel{785}}{9} \times \frac{8}{\cancel{785}} = \frac{8}{9}.$$

$$\frac{\frac{7}{5}}{2\frac{1}{5}} = \frac{\frac{7}{5}}{\frac{7}{5}} = \frac{7}{8} \times \frac{3}{\cancel{7}} = \frac{3}{8}.$$

$$\frac{81\frac{5}{11}}{128} = \frac{\frac{896}{11}}{\frac{128}{1}} = \frac{\overset{7}{\cancel{896}}}{11} \times \frac{1}{\cancel{128}} = \frac{7}{11}.$$

$$\frac{5}{\cancel{7}} \times \frac{\overset{8}{\cancel{9}}}{\underset{3}{\cancel{9}}} \times \frac{\overset{1}{\cancel{3}}}{\cancel{8}} \times \frac{\cancel{7}}{11} = \frac{5}{33} \text{ Ans.}$$

SECTION XX.

DIVISION OF VULGAR FRACTIONS.

CASE I.

2. (p. 125.)	$\frac{7}{198}$.	5.	$\frac{1}{960}$.	8.	$\frac{5}{1007}$.
3.	$\frac{15}{616}$.	6.	$\frac{11}{1668}$.	9.	$\frac{16}{1421}$.
4.	$\frac{1}{459}$.	7.	$\frac{14}{437}$.	10.	$\frac{1}{225}$.

CASE II.

2. (p. 126.)	$28\frac{3}{7}$.	5.	960.	8.	$200\frac{2}{5}$.
3.	$41\frac{1}{15}$.	6.	$151\frac{5}{11}$.	9.	$88\frac{13}{16}$.
4.	459.	7.	$31\frac{3}{14}$.	10.	225.

CASE III.

2. (p. 126.)	$3\frac{13}{72}$.	6.	\$ $4\frac{10}{63}$.	10.	\$ $5.65\frac{5}{39}$.
3.	$2\frac{1}{14}$.	7.	\$ $8\frac{26}{33}$.	11.	\$ $0.21\frac{19}{21}$.
4.	$1\frac{13}{64}$.	8.	$20\frac{3}{22}$cwt.	12.	\$ $0.31\frac{5}{16}$.
5.	$2\frac{13}{30}$.	9.	\$ $125.63\frac{13}{24}$.	13.	$192\frac{35}{304}$ acres.

CASE IV.

9. (p. 128.)	$1\frac{2}{5}$.	15.	$\frac{36}{775}$.	21.	$1\frac{1}{6}$.
10.	$1\frac{7}{32}$.	16.	$\frac{18}{407}$.	22.	$\frac{350}{549}$.
11.	$\frac{13}{18}$.	17.	20.	23.	$\frac{675}{1309}$.
12.	$1\frac{16}{105}$.	18.	$1\frac{113}{650}$.	24.	\$ 50.
13.	$\frac{68}{175}$.	19.	$\frac{4840}{81729}$.	25.	\$ $158\frac{48}{63}$.
14.	$11\frac{3}{7}$.	20.	$11\frac{40}{1241}$.		

SECTION XXI.

QUESTIONS TO BE PERFORMED BY ANALYSIS.

3. (p. 129.) $30\frac{4}{15} = \frac{454}{15}$; $\frac{1728}{1} \times \frac{15}{454} = \frac{25920}{454}$; $7\frac{17}{30} = \frac{227}{30}$; $\frac{25920}{454} \times \frac{227}{30} = \frac{5888640}{13620} = \$432$ Ans.

4. $7\frac{17}{30} = \frac{227}{30}$; $\frac{432}{1} \times \frac{30}{227} = \frac{12960}{227}$; $\frac{1728}{1} \times \frac{227}{12960} = \frac{392256}{12960} = 30\frac{4}{15}$ tons, Ans.

5. $7\frac{17}{30} = \frac{227}{30}$; $\frac{432}{1} \times \frac{30}{227} = \frac{12960}{227}$; $30\frac{4}{15} = \frac{454}{15}$; $\frac{454}{15} \times \frac{12960}{227} = \frac{5883840}{3405} = \$1728$ Ans.

6. $30\frac{4}{15} = \frac{454}{15}$; $\frac{1728}{1} \times \frac{15}{454} = \frac{25920}{454}$; $\frac{432}{1} \times \frac{454}{25920} = 7\frac{17}{30}$ tons, Ans.

7. $7\frac{7}{10} = \frac{77}{10}$; $6\frac{4}{8} = \frac{52}{8}$; $\frac{52}{8} \times \frac{77}{10} = \frac{4466}{80} = 49\frac{28}{40}$ bushels, Ans.

8. $\frac{7}{11}$ of $\frac{17}{1} = \frac{119}{11} = 10\frac{9}{11}$; $10\frac{9}{11} + 15 = 25\frac{9}{11} = \frac{284}{11}$; $\frac{1728}{1} \times \frac{11}{284} = \frac{19008}{284} = \$66\frac{66}{71}$, each girl's share; $\frac{7}{11}$ of $66\frac{66}{71} = \frac{7}{11} \times \frac{19008}{284} = \frac{133056}{3124} = \$42\frac{42}{71}$, each boy's share.

9. $\frac{1442}{1} \times \frac{9}{7} = \frac{13041}{7} = 18.63$; $4\frac{3}{7} = \frac{31}{7}$; $\frac{1863}{1} \times \frac{31}{7} = \frac{57753}{7} = \$82.50\frac{3}{7}$ Ans.

10. $82.50\frac{3}{7} = \frac{57753}{7}$; $4\frac{3}{7} = \frac{31}{7}$; $\frac{57753}{7} \times \frac{7}{31} = \frac{404271}{217} = 18.63$; $\frac{1442}{1863} = \frac{7}{9}$ Ans.

11. $\frac{1442}{1} \times \frac{9}{7} = \frac{13041}{7} = 18.63$; $82.50\frac{3}{7} \div 18.63 = 4\frac{3}{7}$ Ans.

12. $82.50\frac{3}{7} = \frac{57753}{7}$; $4\frac{3}{7} = \frac{31}{7}$; $\frac{57753}{7} \times \frac{7}{31} = \frac{404271}{217} = 18.63$; $\frac{7}{9}$ of $\frac{1863}{1} = \frac{13041}{9} = \$14.49$ Ans.

13. $14\frac{7}{8} = \frac{119}{8}$; $\frac{500}{1} \times \frac{8}{119} = \frac{4000}{119}$; $9\frac{11}{12} = \frac{119}{12}$; $\frac{4000}{119} \times \frac{119}{12} = \frac{476000}{1428} = \$333.33\frac{1}{3}$ Ans.

14. $9\frac{11}{12} = \frac{119}{12}$; $333.33\frac{1}{3} = \frac{100000}{3}$; $\frac{100000}{3} \times \frac{12}{119} = \frac{1200000}{357}$; $14\frac{7}{8} = \frac{119}{8}$; $\frac{1200000}{357} \times \frac{119}{8} = \frac{142800000}{28536} = \$500$ Ans.

15. $333.33\frac{1}{3} = \frac{100000}{3}$; $9\frac{11}{12} = \frac{119}{12}$; $\frac{100000}{3} \times \frac{12}{119} = \frac{1200000}{357}$; $\frac{5000000}{1} \times \frac{357}{12000000} = \frac{1785}{120} = 14\frac{7}{8}$ tons, Ans.

16. $14\frac{7}{8} = \frac{119}{8}$; $\frac{50000}{1} \times \frac{8}{119} = \frac{400000}{119}$; $333.33\frac{1}{3} = \frac{100000}{3}$; $\frac{100000}{3} \times \frac{119}{400000} = \frac{11900000}{1200000} = 9\frac{11}{12}$ tons, Ans.

17. $97\frac{7}{8} = \frac{783}{8}$; $\frac{8132}{1} \times \frac{8}{783} = \frac{25056}{783} = .32$; $763\frac{5}{8} \times .32 = \$244.36$ Ans.

18. $763\frac{5}{8} = \frac{6102}{8}$; $\frac{24436}{1} \times \frac{8}{6109} = \frac{195488}{6109} = .32$; $97\frac{7}{8} \times .32 = \$31.32$ Ans.

19. $763\frac{5}{8} = \frac{6102}{8}$; $\frac{24436}{1} \times \frac{8}{6109} = \frac{195488}{6109} = .32$; $31.32 \div .32 = 97\frac{7}{8}$gal. Ans.

20. $1975 \div 40 = 49\frac{3}{8}$; $49\frac{3}{8} \times 144 = 7110$lb. Ans.

21. $15.75 \div 17 = 92\frac{11}{17}$; $92\frac{11}{17} = \frac{1575}{17}$; $9\frac{1}{4} = \frac{37}{4}$; $\frac{1575}{17} \times \frac{37}{4} = \frac{58275}{68} = \$8.56\frac{67}{68}$ Ans.

22. $50\frac{4}{7} = \frac{354}{7}$; $\frac{1}{8} \times \frac{354}{7} = \frac{354}{63}$; $87\frac{3}{5} = \frac{438}{5}$; $\frac{354}{63} \times \frac{438}{5} = \frac{155052}{315} = \$492\frac{8}{35}$ Ans.

23. $78 \times 13 = 1014$; $13 + 7 = 20$; $1014 \div 20 = 50\frac{7}{10}$ days, Ans.

24. $10 \times 9 = 90$; $90 \div 15 = 6$ days, Ans.

25. $15 \times 6 = 90$; $90 \div 10 = 9$ days, Ans.

26. $10 \times 9 = 90$; $90 \div 6 = 15$ hours, Ans.

27. $17\frac{3}{11} = \frac{190}{11}$; $5\frac{3}{7} = \frac{38}{7}$; $\frac{38}{7} \times \frac{11}{190} = \frac{418}{1330}$; $97\frac{8}{9} = \frac{878}{9}$; $\frac{418}{1330} \times \frac{878}{9} = \frac{367004}{11970} = \$30\frac{2}{315}$ Ans.

28. $9\frac{3}{5} = \frac{48}{5}$; $19\frac{7}{9} = \frac{178}{9}$; $\frac{178}{9} \times \frac{48}{5} = \frac{8544}{45} = 189\frac{13}{15}$; $189\frac{13}{15} + 7 = 196\frac{13}{15}$; $9\frac{3}{5}$ tons $= 192$cwt.; $196\frac{13}{15} \div 192 = \$1\frac{73}{2880}$ Ans.

29. $9\frac{3}{5}$ tons $= 192$ cwt.; $192 \times 1\frac{3}{4} = 336$; $336 - 7 = \$329$, Ans.

30. $47\frac{3}{11} = \frac{520}{11}$; $2\frac{2}{3} = \frac{8}{3}$; $\frac{520}{11} \times \frac{8}{3} = \frac{4160}{33} = 126\frac{2}{33}$; $0.75 = \frac{3}{4}$; $126\frac{2}{33} \div \frac{3}{4} = 168\frac{8}{99}$ bushels, Ans.

31. $57\frac{9}{11} = \frac{636}{11}$; $\frac{636}{11} \times \frac{1}{15} = \frac{636}{165}$; $19\frac{7}{8} = \frac{159}{8}$; $\frac{636}{165} \times \frac{159}{8} = \frac{101124}{1320} = \$76\frac{67}{110}$ Ans.

32. $19\frac{7}{8} = \frac{159}{8}$; $76\frac{67}{110} = \frac{101124}{1320}$; $\frac{101124}{1320} \times \frac{8}{159} = \frac{808992}{209880} = \frac{636}{165}$; $57\frac{9}{11} = \frac{636}{11}$; $\frac{636}{11} \times \frac{1}{636} = 15$ cords, Ans.

33. $7\frac{3}{10} = \frac{73}{10}$; $47\frac{1}{3} = \frac{142}{3}$; $\frac{142}{3} \times \frac{73}{10} = \frac{10366}{30} = 345\frac{8}{15}$s. $= 17$£. 5s. $6\frac{2}{5}$d. Ans.

34. 172£. 15s. $0\frac{2}{5}$d. $= \frac{207302}{5}$d.; $47\frac{1}{3} = \frac{142}{3}$; $\frac{207302}{5} \times \frac{3}{142} = \frac{621906}{710} = 875\frac{328}{355}$d. $= 3$£. 12s. $11\frac{328}{355}$d. Ans.

35. $43\frac{6}{7} = \frac{307}{7}$; $\frac{307}{7} \times \frac{7}{13} = \frac{2149}{91} = \$23.61\frac{7}{13}$ Ans.

36. $17\frac{3}{8} = \frac{139}{8}$; $2\frac{7}{11} = \frac{29}{11}$; $\frac{29}{11} \times \frac{8}{139} = \frac{232}{1529}$; $\frac{232}{1529} \times \frac{50}{1} = \frac{11600}{1529} = \$7.58\frac{1018}{1529}$ Ans.

37. $87\frac{3}{7} = \frac{612}{7}$; $\frac{612}{1} \times \frac{7}{612} = 7$; $14\frac{7}{10} \times 7 = \$\ 102.90$ Ans.

38. $\frac{4375}{1} \times \frac{8}{7} = \frac{35000}{7} = 50$; $50 \times 10 = \$\ 500$ Ans.

39. $500 \div 10 = 50$; $\frac{4375}{5000} = \frac{7}{8}$ acre, Ans.

40. $71.87 \div 9 = 7.98\frac{5}{8} = \frac{7187}{9}$; $\frac{4}{7} \times \frac{7187}{9} = \frac{28748}{63} = \$\ 4.56\frac{20}{63}$ Ans.

41. $4.56\frac{20}{63} \times \frac{7}{4} = 7.98\frac{5}{8}$; $7.98\frac{5}{8} \times 9 = \$\ 71.87$ Ans.

42. $111 \times 19 = 2109$; $2109 \div 47 = 44\frac{41}{47}$ days, Ans.

43. $44\frac{41}{47} \times 47 = 2109$; $2109 \div 19 = 111$ days, Ans.

44. $\frac{2320}{1} \times \frac{11}{4} = \frac{10120}{4} = 25.30$; $25.30 \times 17 = \$\ 430.10$ Ans.

45. $430.10 \div 17 = 25.30$; $\frac{4}{11} \times \frac{2530}{1} = \frac{10120}{11} = \$\ 9.20$ Ans.

46. $\frac{7115}{1} \times \frac{16}{7} = \frac{11440}{7} = 16.34\frac{2}{7}$; $16.34\frac{2}{7} \times 7 = \$114.40$ Ans.

47. $\frac{7}{16} \times \frac{11440}{1} = \frac{11440}{16} = \$\ 7.15$ Ans.

48. $8\frac{1}{2} = \frac{17}{2}$; $11\frac{1}{4} = \frac{45}{4}$; $\frac{17}{2} \times \frac{45}{4} = \frac{765}{8}$; $\frac{1}{10} \times \frac{765}{8} = \frac{765}{80}$ $= 9\frac{9}{16}$ days, Ans.

49. $19 \div 4 = 4\frac{3}{4}$; $25 \times 4\frac{3}{4} = \$\ 118.75$ Ans.

50. $87.25 \div 15 = 5.81\frac{2}{3}$; $5.81\frac{2}{3} \times 100 = \$\ 581.66\frac{2}{3}$ Ans.

51. $81.75 \div 20 = 4.08\frac{3}{4}$; $4.08\frac{3}{4} \times 70 = \$\ 286.12\frac{1}{2}$ Ans.

52. $19\frac{7}{12} = \frac{235}{12}$; $\frac{1975}{1} \times \frac{235}{12} = \frac{46412}{24} = \$\ 193.38\frac{13}{24}$ Ans.

53. $47.25 \div 3 = 15.75$; $15.75 \times 11\frac{5}{12} = \$\ 179.81\frac{1}{4}$ Ans.

54. $\frac{50}{47} \times \frac{5}{1} = \frac{250}{47} = \$\ 5.31\frac{43}{47}$ Ans.

55. $13\frac{2}{7} = \frac{93}{7}$; $\frac{3000}{19} \times \frac{93}{7} = \frac{279000}{133} = \$\ 209.77\frac{59}{133}$ Ans.

56. $\frac{6}{4} = \frac{3}{2}$; $\frac{180}{1} \times \frac{2}{3} = \frac{360}{3} = 120$ feet, Ans.

57. $20 \times 8 = 160$; $160 \div 12 = 13\frac{1}{3}$ days, Ans.

58. $5 \times 10 \times 23 = 1150$ hours; $1150 \div 46 = 25$ hours; 25 hours $\div 8 = 3\frac{1}{8}$ days, Ans.

59. Smith will reap $\frac{1}{80}$ of the field in an hour; his wife will reap $\frac{1}{108}$ of the field in an hour. They will both reap $\frac{1}{80} + \frac{1}{108} = \frac{47}{2160}$ of the field in an hour. Then they will reap the whole field in $\frac{2160}{47}$ hours $= 45\frac{45}{47}$; $45\frac{45}{47} \div 8 = 5\frac{37}{47}$ days, Ans.

60. 15tons 7cwt. 2qr. 18lb. = 34458lb.; $\$\ 2067.48 \div 34458 = 6$ cents per lb.; 1 ton = 2240lb.; $2240 \times 6 = \$\ 134.40$ per ton; $\$\ 134.40 \times 78 = \$\ 10483.20$ Ans.

61. $9\frac{7}{8} = 9.87\frac{1}{2} = \frac{1975}{2}$; $\frac{1}{87} \times \frac{1975}{2} = \frac{1975}{174}$; $\frac{7387}{1} \times \frac{174}{1975} = \frac{1285338}{1975} = 650\frac{1588}{1975}$ miles, Ans.

62. $\frac{5}{8} \times 96\frac{3}{8} = 60\frac{15}{64}$; $96\frac{3}{8} - 60\frac{15}{64} = 36\frac{9}{64}$; $36\frac{9}{64} \div 2 = 18\frac{9}{128}$ yards, Ans.

63. $\frac{23}{12} + \frac{11}{12} = \frac{23}{12}$, horse and chaise; $\frac{23}{12} = \$\,250$; $250 \div 23 = 10\frac{20}{23}$; $10\frac{20}{23} \times 12 = \$\,130\frac{10}{23}$, horse; $10\frac{20}{23} \times 11 = \$\,119\frac{13}{23}$, chaise; $\frac{7}{11} \times 130\frac{10}{23} = \$\,83\frac{1}{23}$, harness.

64. $\frac{1}{7} \times \frac{4}{1} = \$\,\frac{4}{7}$ a bushel; $17\frac{5}{8} = \frac{141}{8}$; $\frac{141}{8} \times \frac{7}{4} = \frac{987}{32} = 30\frac{27}{32}$ bushels, Ans.

65. $2\frac{3}{7} = \frac{17}{7}$; $17\frac{4}{7} = \frac{123}{7}$; $\frac{123}{7} \times \frac{7}{17} = \frac{123}{17} = 7\frac{4}{17}$A. Ans.

66. $17\frac{4}{7} = \frac{123}{7}$; $7\frac{4}{17} = \frac{123}{17}$; $\frac{123}{7} \times \frac{17}{123} = \frac{17}{7} = 2\frac{3}{7}$bu. Ans.

67. $1.37\frac{1}{2} \times 47\frac{3}{4} = 65.65\frac{5}{8}$; $176.18 - 65.65\frac{5}{8} = 110.52\frac{3}{8} = \frac{88418}{8}$; $2\frac{3}{7} = 2.42\frac{6}{7} = \frac{1700}{7}$; $\frac{88418}{8} \times \frac{7}{1700} = \frac{618373}{13600} = 45\frac{6933}{13600}$ bushels, Ans.

68. $8\frac{1}{5} = \frac{41}{5}$; $\frac{41}{5} \times \frac{1}{7} = \frac{41}{35} = \$\,1.17\frac{1}{7}$ Ans.

69. $18\frac{2}{9} = \frac{164}{9}$; $\frac{2147}{1} \times \frac{9}{164} = \frac{19323}{164}$; $7\frac{4}{5} = \frac{39}{5}$; $\frac{19323}{164} \times \frac{39}{5} = \frac{753597}{820} = \$\,9.19\frac{17}{820}$ Ans.

70. 17£. 8s. 11d. = 4187d.; $9\frac{3}{11} = \frac{102}{11}$; $\frac{4187}{1} \times \frac{11}{102} = \frac{46057}{102}$; $19\frac{4}{7} = \frac{137}{7}$; $\frac{46057}{102} \times \frac{137}{7} = \frac{6309809}{714} = 8837\frac{191}{714}$d. = 36£. 16s. $5\frac{191}{714}$d. Ans.

71. $756\frac{4}{11} = \frac{8320}{11}$; $7\frac{31}{55} = \frac{416}{55}$; $\frac{8320}{11} \times \frac{55}{416} = \frac{416000}{4416} =$ 100 garments, Ans.

72. $18\frac{4}{7} = \frac{130}{7}$; $\frac{2000}{1} \times \frac{7}{130} = \frac{63000}{130}$; $171\frac{3}{8} = \frac{1371}{8}$; $\frac{63000}{130} \times \frac{1371}{8} = \frac{86373000}{1040} = \$\,830.502\frac{5}{28}$ Ans.

73. $147\frac{3}{11} = \frac{1620}{11}$; $36\frac{4}{9} = \frac{328}{9}$; $\frac{1620}{11} \times \frac{9}{328} = \frac{14580}{3608}$; $971\frac{4}{8} = \frac{3884}{4}$; $\frac{14580}{3608} \times \frac{3884}{4} = \frac{56671632}{14432} = 3923\frac{169}{3608}$ miles, Ans.

74. $97\frac{3}{4} = \frac{391}{4}$ $\frac{400}{1} \times \frac{4}{391} = \frac{2000}{391}$; $32\frac{7}{12} = \frac{391}{12}$; $\frac{2000}{391} \times \frac{391}{12} = \frac{2000}{12} = 166\frac{2}{3}$ miles, Ans.

75. $19\frac{3}{7} = \frac{136}{7}$; $87\frac{3}{7} = \frac{612}{7}$; $\frac{136}{7} \times \frac{7}{612} = \frac{136}{612} = \frac{34}{153}$; $\frac{34}{153} \times \frac{60}{1} \times \frac{7}{1} = \frac{14280}{153} = 93\frac{1}{3}$bu. Ans.

NOTE. The pupil will find, in performing the above questions, that he can abridge the operation by *cancellation*.

MISCELLANEOUS QUESTIONS.

1. (p. 133.) $17\frac{3}{11} = \frac{190}{11}$; $4\frac{7}{9} = \frac{43}{9}$; $\frac{190}{11} \times \frac{43}{9} = \frac{8170}{99} = 82\frac{82}{99}$ miles, = 82m. 4fur. 8rd. 1ft. 4in. Ans.

2. $29\frac{7}{13} = \frac{384}{13}$; $\frac{384}{13} \times \frac{384}{13} = \frac{147456}{169} = 872\frac{88}{169}$ poles, = 5A. 1R. $32\frac{88}{169}$p. $\frac{88}{169}$p. = 141ft. $109\frac{155}{169}$in. Ans.

3. $17\frac{3}{4} = \frac{71}{4}$; $7\frac{1}{11} = \frac{78}{11}$; $4\frac{3}{5} = \frac{23}{5}$; $\frac{71}{4} \times \frac{78}{11} \times \frac{23}{5} = \frac{127374}{220} = 578\frac{107}{110}$ feet; $578\frac{107}{110} \div 128 = 4$ cords $66\frac{107}{110}$ cubic feet, Ans.

4. $19\frac{7}{8} = \frac{159}{8}$; $6\frac{3}{4} = \frac{27}{4}$; $\frac{159}{8} \times \frac{27}{4} = \frac{4293}{32} = \$\,134.15\frac{5}{8}$ Ans.

5. $376\frac{11}{18} = \frac{6779}{18}$; $75\frac{3}{8} = \frac{603}{8}$; $\frac{6779}{18} \times \frac{603}{8} = \frac{4087737}{144} = \$\,28387.06\frac{1}{4}$ Ans.

6. $17\frac{19}{112} = \frac{1923}{112}$; $4.75 = \frac{475}{1}$; $\frac{1923}{112} \times \frac{475}{1} = \frac{913425}{112} = \$\,81.55\frac{65}{112}$ Ans.

7. $1670\frac{7}{13} = \frac{21717}{13}$; $12\frac{3}{4} = \frac{51}{4}$; $\frac{21717}{13} \times \frac{51}{4} = \frac{1107567}{52} = \$\,212.99\frac{19}{52}$ Ans.

8. $28\frac{4}{11} = \frac{312}{11}$; $11\frac{3}{4} = \frac{47}{4}$; $\frac{312}{11} \times \frac{47}{4} = \frac{14664}{44} = \$\,333.27\frac{3}{11}$ Ans.

9. $37\frac{11}{63} = \frac{2342}{63}$; $17.62\frac{1}{2} = \frac{3525}{2}$; $\frac{2342}{63} \times \frac{3525}{2} = \frac{8255850}{126} = \$\,655.20\frac{5}{21}$ Ans.

10. $\frac{7}{8} \times \frac{575}{1} = \frac{4025}{8} = \$\,5.03\frac{1}{8}$ Ans.

11. $1394\frac{1}{7} = \frac{9771}{7}$; $384\frac{1}{5} = \frac{1921}{5}$; $\frac{9771}{7} \times \frac{1921}{5} = \frac{18815391}{35} = 5415\frac{14}{35}$ poles = 33A. 3R. $15\frac{14}{35}$p. Ans.

12. $11\frac{3}{5} = \frac{58}{5}$; $\frac{58}{5} \times \frac{15}{1} = \frac{870}{5}$; $\frac{870}{5} \times \frac{1}{8} = \frac{870}{40} = 19\frac{1}{8}$ feet, Ans.

13. $18\frac{3}{8} = \frac{147}{8}$; $48.15\frac{3}{4} = \frac{19263}{4}$; $\frac{19263}{4} \times \frac{8}{147} = \frac{154104}{588} = \$\,2.62\frac{4}{49}$ Ans.

14. $987\frac{1}{8} = \frac{7897}{8}$; $\frac{7897}{8} \times \frac{1}{63} = \frac{7897}{504} = \$\,1.56\frac{169}{1296}$ Ans.

15. $8\frac{2}{9} = \frac{74}{9}$; $\frac{74}{9} \times \frac{1}{5} = \frac{74}{45} = \$\,1.64\frac{4}{9}$ Ans.

16. $11 \times 63 = 693$; $693 + 17\frac{1}{2} = 710\frac{1}{2} = \frac{1421}{2}$; $19\frac{3}{4} = \frac{79}{4}$; $\frac{1421}{2} \times \frac{79}{4} = \frac{112259}{8} = \$\,140.32\frac{3}{8}$ Ans.

17. $63 \times 4 \times 2 = 504$pts.; $1\frac{3}{4} = \frac{7}{4}$; $\frac{504}{1} \times \frac{4}{7} = \frac{2016}{7} = 288$ bottles, Ans.

18. $18\frac{7}{12} = \frac{223}{12}$; $10\frac{5}{12} = \frac{125}{12}$; $7\frac{11}{12} = \frac{95}{12}$; $\frac{223}{12} \times \frac{125}{12} \times \frac{95}{12}$

$= \frac{2648125}{1728} = 1532\frac{829}{1728}$ cubic feet. $1532\frac{829}{1728} \div 128$ $= 11$ cords $124\frac{829}{1728}$ cubic feet, Ans.

19. $6\frac{7}{8} = \frac{55}{8}$; $65\frac{3}{4} = \frac{263}{4}$; $\frac{55}{8} \times \frac{263}{4} = \frac{14465}{32} = \$4.52\frac{1}{32}$ Ans.

20. $8\frac{3}{4} = \frac{35}{4}$; $5\frac{7}{12} = \frac{67}{12}$; $3 = \frac{3}{1}$; $\frac{35}{4} \times \frac{67}{12} \times \frac{3}{1} = \frac{7035}{48} =$ $146\frac{9}{16}$ feet, Ans.

21. $46\frac{5}{12} = \frac{557}{12}$; $17\frac{1}{2} = \frac{35}{2}$; $\frac{557}{12} \times \frac{35}{2} = \frac{19495}{24} = 812\frac{7}{24}$ feet, Ans.

22. $2\frac{5}{12} + 3\frac{1}{12} = 5\frac{6}{12}$; $5\frac{6}{12} \times \frac{2}{1} = 11$; $11 \times 5\frac{1}{2} = 60\frac{1}{2}$, $2\frac{5}{12} = \frac{29}{12}$; $3\frac{1}{12} = \frac{37}{12}$; $\frac{29}{12} \times \frac{37}{12} \times \frac{2}{1} = \frac{2146}{144} = 14\frac{65}{72}$; $60\frac{1}{2} + 14\frac{65}{72} = 75\frac{29}{72}$; $75\frac{29}{72} \times \frac{7}{1} = 527\frac{59}{72}$ feet, Ans.

$5\frac{6}{12} = \frac{66}{12}$; $2\frac{5}{12} = \frac{29}{12}$; $3\frac{1}{12} = \frac{37}{12}$; $\frac{66}{12} \times \frac{29}{12} \times \frac{37}{12}$ $\times \frac{7}{1} = \frac{49577}{1728} = 286\frac{53}{288}$ cubic feet, Ans.

23. $12 + 11\frac{1}{2} = 23\frac{1}{2}$; $23\frac{1}{2} \times 2 = 47$; $47 \times 7\frac{1}{2} = 352\frac{1}{2}$; $12 \times 11\frac{1}{2} = 138$; $352\frac{1}{2} + 138 = 490\frac{1}{2}$; $490\frac{1}{2} \times .02\frac{3}{4}$ $= \$13.48\frac{7}{8}$ Ans.

24. $14\frac{1}{2} = \frac{29}{2}$; $10\frac{1}{4} = \frac{41}{4}$; $16\frac{1}{2} = \frac{33}{2}$; $\frac{29}{2} \times \frac{33}{2} = \frac{957}{4} =$ $239\frac{1}{4}$; $\frac{41}{4} \times \frac{33}{2} = \frac{1353}{8} = 169\frac{1}{8}$; $239\frac{1}{4} + 169\frac{1}{8} =$ $408\frac{3}{8}$; $408\frac{3}{8} \times 2 = 816\frac{3}{4}$; $816\frac{3}{4} + 12 = 828\frac{3}{4}$; $828\frac{3}{4}$ $\times 3 \times 4\frac{1}{2} \times 2 = \$223.76\frac{1}{4}$ Ans.

25. $14\frac{7}{12} = \frac{175}{12}$; $5\frac{11}{12} = \frac{71}{12}$; $4\frac{1}{4} = \frac{17}{4}$; $2150\frac{2}{5} = \frac{10752}{5}$; $\frac{175}{12} \times \frac{71}{12} \times \frac{17}{4} \times \frac{1728}{1} \times \frac{5}{10752} = \frac{18249840000}{61931152} =$ $294\frac{24229}{35684}$ bushels, Ans.

26. $10 \times 8 \times 6 = 480$; $8 \times 8 \times 8 = 512$; $512 - 480 =$ 32 feet, Ans.

27. $1112\frac{5}{8} = \frac{8901}{8}$; $\frac{8901}{8} \times \frac{1}{129} = \frac{8901}{1032} = \$8\frac{5}{8}$ Ans.

28. $7\frac{11}{12} = \frac{95}{12}$; $\frac{95}{12} \times \frac{68}{1} = \frac{6460}{12} = \$538\frac{1}{3}$ Ans.

29. $8\frac{2}{3} = \frac{26}{3}$; $42\frac{3}{5} = \frac{213}{5}$; $\frac{26}{3} \times \frac{213}{5} = \frac{5538}{15} = \$369.20$ Ans.

30. $\frac{3}{3} - \frac{3}{3} = 0$.

31. $20 \times 15 = 300$ft., contents of upper part of the room.
$20 + 15 = 35$; $35 \times 2 = 70$ft., length round the room.
$70 \times 8\frac{1}{2} = 595$ft., contents of upright ceiling of the room.
$2 \times 7 \times 3 = 42$ft., contents of the doors.
$4 \times 5\frac{1}{2} \times 3\frac{1}{3} = 73\frac{1}{3}$ft., contents of the windows.

$70 - 6 = 64$; $64 \times \frac{2}{3} = 42\frac{2}{3}$ft., contents of mopboards.

NOTE. We deduct 6 feet for the two doors.

$595 + 300 = 895$; $42 + 73\frac{1}{3} + 42\frac{2}{3} = 158$.

$895 - 158 = 737$ feet; $737 \div 9 = 81\frac{8}{9}$ square yards.

$81\frac{8}{9} \times 6\frac{1}{4} = \frac{737}{9} \times \frac{25}{4} = \frac{18425}{36} = \$\,5.11\frac{29}{36}$ for plastering.

$595 - 158 = 437$ft.; $437 \div 9 = 48\frac{5}{9}$ square yards.

$48\frac{5}{9} \times .09 = \$\,4.37$ for papering.

$48\frac{5}{9} \times 3 = 145\frac{2}{3} = \frac{437}{3}$; $2\frac{3}{5} = \frac{13}{5}$; $\frac{437}{3} \div \frac{13}{5} = \frac{437}{3} \times \frac{5}{13} = \frac{2185}{39} = \$\,2.80\frac{5}{39}$ for paper.

SECTION XXII.

NUMERATION OF DECIMAL FRACTIONS.

1.	(p. 136.)	325.7
2.		465.14
3.		93.07
4.		24.000009
5.		221.00009
6.		49000.049
7.		79002000.105
8.		69015.00015
9.		80000.0083
10.		9000019019.19
11.		27.927
12.		49000000000000.000000000001
13		21.0001
14.		87000.000087
15.		99099.000009009
16.		17.0117
17.		33.33
18.		47000.0000029
19.		15.04007
20.		11000.11
21.		17.000000000000081
22.		9.000000000057
23.		69000.349

SECTION XXIII.

ADDITION OF DECIMALS.

2. (p. 138.) 7564.0052656 | 4. 7234.0968
3. 2071.449495 | 5. 6913.5477

6.
73.29
87.047
3005.0106
28.03
29000.005
Ans. 32193.3826

7.
209000.000046
98207.0015
15.08
.0049
Ans. 307222.086446

8.
23000010.
1000.00005
27.000019
7.5
Ans. 23001044.500069

9.
59.059
25000.0025
5.000005
205.05
Ans. 25269.111505

10.
25.000007
145.643
175.89
17.00348
Ans. 363.536487

SECTION XXIV.

SUBTRACTION OF DECIMALS.

5. (p. 139.) 19.7233 | 6. 9.49989 | 7. 88.9429 | 8. .001

9.
97.7
27.028
Ans. 70.672

10.
315.0027
115.07
Ans. 199.9327

11.
29004005.
29000.
349200.00024
378200.00024
Ans. 28625804.99976

12.
1000000.
.000001
Ans. 999999.999999

SECTION XXV.

MULTIPLICATION OF DECIMALS.

13.	(p. 140.) .438496	23.	.000019737
14.	.0949416	24.	225.
15.	.03721061	25.	$ 153.52,5
16.	26137.65	26.	$ 18.43,75
17.	152.2756	27.	$ 46.95
18.	43910.073	28.	$ 149.51,25
19.	.00000081	29.	$ 3616.17,5
20.	2401.	30.	$ 138.37,5
21.	33.5175	31.	$ 109.66,5
22.	41448651.06	32.	$ 49.53

SECTION XXVI.

DIVISION OF DECIMALS.

9.	(p. 141.) 321.2	19.	3124.3
10.	.758	20.	.31243
11.	.561	21.	312430000.
12.	13.861+	22.	.000031243
13.	749.084	23.	312.43
14.	32000.	24.	31243000000.
15.	.000032	25.	.31243
16.	.5403+	26.	.31243
17.	.0623		

SECTION XXVII.

REDUCTION OF DECIMALS.

CASE II.

2. (p. 143.)

20 | 9.00

.45 Ans.

3.

28 | 14.0
4 | 3.5
20 | 15.875

.79375 Ans

4.

16 | 12.00
16 | 8.750000
28 | 21.54687500
4 | 2.76953125 00

.692382812 5 Ans.

5.

4 | 3.00
4 | 1.7500

.4375 Ans.

6.

12	9.00
3	2.750000000
5½	2.916666666
40	35.530303303
8	5.888257577
	.736032191+ Ans.

7.

2	1.0
4	2.500
63	3.625000000
	.057539681+ Ans.

8.

2	1.0
8	0.50
4	0.062500
	.015625 Ans.

9.

40	16.0
4	2.4
	.6 Ans.

CASE III.

2. (p. 144.)

13s. 6¾d.
.6
.05
.028
.678 Ans.

3.

19s. 8¼d.
.950
34
.984 Ans.

4.

19s. 11¾d. = .950 / 49 / .999
16s. 9¼d. = .800 / 39 / .839
1s. 11d. = .050 / 46 / .096
3s. 0¾d. = .150 / 3 / .153
17s. 5½d. = .850 / 23 / .873
13s. 4½d. = .650 / 19 / .669

18s. 8½d. = .900 / 35 / .935
19s. 11¾d. = .950 / 49 / .999
13s. 3½d. = .650 / 14 / .664
16s. 0¼d. = .800 / 1 / .801
17s. 7¾d. = .850 / 32 / .882
£7.910 Ans.

CASE IV.

2. (p. 145.) $.625 \times 12 = 7.5$d.; $.5 \times 4 = 2.$qr; $7\frac{1}{2}$ Ans.

3. $.6725 \times 4 = 2.69$; $.69 \times 28 = 19.32$; $.32 \times 16 = 5.12$; $.12 = \frac{3}{25}$; 2qr. 19lb. $5\frac{3}{25}$oz. Ans.

4. $.9375 \times 4 = 3.75$; $.75 \times 4 = 3.$; 3qr. 3na. Ans.

5. $.7895 \times 8 = 6.316$; $.316 \times 40 = 12.64$; $.64 \times 16\frac{1}{2} = 10.56$; $.56 \times 12 = 6.72$; $.72 = \frac{18}{25}$; 6fur. 12rd. 10ft. $6\frac{18}{25}$in. Ans.

6. $.9378 \times 4 = 3.7512$; $.7512 \times 40 = 30.048$; $.048 \times 272\frac{1}{4} = 13.068$; $.068 \times 144 = 9.792$; $.792 = \frac{99}{125}$; 3R. 30p. 13ft. $9\frac{99}{125}$in. Ans.

7. $.5615 \times 63 = 35.3745$; $.3745 \times 4 = 1.498$; $.498 \times 2 = .996$; $.996 \times 4 = 3.984$; $.984 = \frac{123}{125}$; 35gal. 1qt. 0pt. $3\frac{123}{125}$gi. Ans.

8. $.367 \times 365\frac{1}{4} = 134.046\frac{3}{4}$; $.046\frac{3}{4} \times 24 = 1.122$; $.122 \times 60 = 7.32$; $.32 \times 60 = 19.2$; $.2 = \frac{1}{5}$; 134da. 1h. 7m. $19\frac{1}{5}$sec. Ans.

9. $.6923828125 \times 4 = 2.76953125$; $.76953125 \times 28 = 21.546875$; $.546875 \times 16 = 8.75$; $.75 \times 16 = 12$; 2qr. 21lb. 8oz. 12dr. Ans.

10. $.015625 \times 4 = .0625$; $.0625 \times 8 = .5$; $.5 \times 2 = 1$; 1 pint, Ans.

11. $.55 \times 5 = 2.75$; $.75 \times 4 = 3$; 2qr. 3na. Ans.

12. $.6 \times 4 = 2.4$; $.4 \times 40 = 16$; 2R. 16p. Ans.

SECTION XXVIII.

MISCELLANEOUS EXAMPLES.

1. (p. 145.)

28 | 18.00
4 | 2.64$\frac{3}{7}$
7.66$\frac{1}{4}$
11.75
3830
5362
766
766 83$\frac{13}{14}$
900.01,3,31$\frac{13}{14}$ =
$900.01,3$\frac{11}{28}$ Ans.

2.

28 | 14.0
4 | 3.500
19.875
9.25
99375
39750
178875
183.84,3,75 =
$183.84,3$\frac{3}{4}$ Ans.

3.

40 | 15.000
4 | 2.37500
39.59375
87.375
197968 75
27715625
11878125
27715625
31675000
3459.50,3,90625 =
$3459.50,3$\frac{29}{32}$ Ans.

4.

40 | 15.000
8 | 3.375000
87.421875
578.75
437109375
611953125
699375000
611953125
437109375
50595.41,0,15625 =
50595.41\frac{1}{64}$ Ans.

5.

12 | 9.00
18.75
2.29$\frac{1}{6}$
16875
3750
3750
3125
42.96875
.053
12890625
21484375
2.27734375 = $2.27,7$\frac{11}{32}$ Ans.

12 | 350
2.29$\frac{1}{6}$

6.

12 | 7.168
1.597$\frac{1}{3}$
6.5
7985
9582
21$\frac{2}{3}$
10.3826$\frac{2}{3}$
12
4.5920

10ft. 4.592in. Ans.

7.

$29\frac{1}{2} = 29.5$

4.316)29.500(6h. 50m. 6+sec. [Ans.
25896
3604
60
4.316)216240(50m.
21580
440
60
4.316)26400(6+sec.
25896

8.

4 | 2.0
4 | 1.500
5.375
5.625
26875
10750
32250
26875
30.23,4,375 =
$30.23,4\frac{3}{8}$ Ans.

9.

28 | 7.00
4 | 3.2500
4.8125
5.875
240625
336875
385000
240625
28.2734375
17
19791406 25
2827343 75
480.64,8,4375 =
$480.64,8\frac{7}{16}$ Ans.

10.

40 | 25.000
4 | 3.625
176.90625
75.375
884531 25
1238343 75
5307187 5
8845312 5
12383437 5
13334.30,8,59375 =
$13334.30,8\frac{19}{32}$ Ans.

11.

17.625
12.75
88125
123375
35250
17625
224.71875 =
$224.71,8\frac{3}{4}$ Ans.

12.

19ft. 3in. = 19.25
15ft. 9in. = 15.75
9625
13475
9625
1925
303.1875
144
7500
7500
1875
27.0000
303ft. 27in. Ans.

13.

14ft. 6in. = 14.5; 12ft. 6in. = 12.5; 8ft. 9in. = 8.75; 14.5 + 12.5 = 27.; 27. × 2 = 54.; 8.75 × 54. = 472.5; 472.5 ÷ 9 = 52½yds. Ans.

14.

10ft. 7in. = 127; 5ft. 10in. = 70; 127 × 70 × 4 = 35560; 35560 ÷ 144 = 246$\frac{11}{18}$ft. Ans.

15.

4 | 3.00
4 | 2.75
4.6875

4 | 2.0
112.5

4.6875)1125.000(24 Ans.
93750
187500
187500

16.

2 | 1.0
4 | 2.500
1.625

1.82 ÷ 1.625 = 1.12;
1.12 × 63 = $ 70.56 Ans.

17.

125½yd. = 125.5
15.06 ÷ 125.5 = $ 0.12 Ans.

18.

4 | 3.00
17.75
35.75
8875
12425
8875
53250
6345.62,5 =
$ 6345.62½ Ans.

19.

87.25 × 7$\frac{7}{63}$ = 675.84$\frac{8}{63}$
$ 675.84$\frac{8}{63}$ Ans.

20.

34ft. 9in. = 34.75; 1ft. 3in. = 1.25; 1ft. 6in. = 1.5
34.75 × 1.25 × 1.5 = 65.15625ft. Ans.

21.

28 | 7.00
4 | 1.2500
2.3125
1775
115625
161875
161875
23125
41.046875 = 41cwt. 0qr. 5$\frac{1}{4}$lb.
4
.187500
28
1500000
375000
5.250000

22.

4 | 1 00
18.25

36.50 ÷ 18.25 = $2.00 Ans.

23.

$477.72 ÷ 9 = $53.08 Ans.

24.

5.375
1.78
1.1875
1.125
1.275
2625
13.3675 =
$13.36,7$\frac{1}{2}$ Ans.

25.

$2\frac{3}{8} = 2.375$; $3\frac{7}{8} = 3.875$; $1\frac{1}{16} = 1.0625$
2.375 + 3.875 + 1.0625 = 7.3125
17.625
365625
146250
438750
511875
73125
128.8828125 =
$128.88,2\frac{13}{16}$ Ans.

26.

28 | 7.00
4 | 2.2500
3.5625
13.625
178125
71250
213750
106875
35625
48.5390625 =
$48.53,9\frac{1}{16}$ Ans.

27.

40 | 35.000
4 | 3.87500
37.96875
125.75
189843 75
26578125
18984375
7593750
3796875
4774.5703125 =
$4774.57,0\frac{5}{16}$ Ans.

28.

28 | 21.00
4 | 2.7500
17.6875
11.25
884375
353750
176875
176875
198.98,4,375 =
$198.98,4$\frac{3}{8}$ Ans.

29.

9.375
3.37
65625
28125
28125
31.59375
7.75
15796875
22115625
22115625
244.85,1,5625 =
$244.85,1$\frac{9}{16}$ Ans.

30.

97.625
7$\frac{42}{63}$
683375
7593$\frac{35}{63}$
759.30,5$\frac{35}{63}$ =
$759.30,5$\frac{35}{63}$ Ans.

31.

4 | 3.00
4 | 3.7500
7.9375
4.75
396875
555625
317500
37.70,3,125 =
$37.70,3$\frac{1}{8}$ Ans.

32.

28 | 3.500
4 | 1.12500
20 | 15.28125
27.76406250
183.62
555281250
166584375 0
83292187 5
2221125000
277640625
5098.03,7,156250 =
$5098.03,7$\frac{5}{32}$ Ans.

33.

40 | 15.000
8 | 3.375000
17.421875
1725.875
87109375
1219531250
139375000
87109375
34843750
121953125
17421875
30067.97,8,515625 =
$30067.97,8$\frac{33}{64}$ Ans.

34.

40 | 15.
4 | 3.375
A. 17.84375

$624.53125 ÷ 17.84375 =
$35 Ans.

35.

28 | 14.
4 | 2.5
20 | 15.625
T. 19.78125

$494.53125 ÷ 19.78125 =
$25 Ans.

36.

40) $1004.75
A. 25.11875
4
R. .47500
40
p. 19.00000
Ans. 25A. 0R. 19p.

37.

9) 157.753125£.
£17.528125
20
s. 10.562500
12
d. 6.750000
4
qr. 3.000000
Ans. 17£. 10s. 6¾d.

38.

28 | 21.
4 | 2.75
cwt. 17.6875

$198.984375 ÷ 17.6875 =
$11.25 Ans.

SECTION XXIX.

EXCHANGE OF CURRENCIES.

3. (p. 150.)

12 | 6.
20 | 7.5
£ 78.375

78.375£. ÷ $\frac{3}{10}$ = $261.25, Ans.

4.

$261.25 × $\frac{3}{10}$ = £78.375
.375 × 20 = s. 7.5
.5 × 12 = d. 6.
78£. 7s. 6d. Ans.

5.

12 | 6.
20 | 16.5
£ 46.825

46.825£. ÷ $\frac{4}{10}$ = $117.06¼

6.

$117.06¼ × $\frac{4}{10}$ = £46.825
.825 × 20 = s. 16.5
.5 × 12 = d. 6.0
46£. 16s. 6d, Ans.

7. $387£. \div \frac{3}{8} = \$\ 1032$ Ans.

8. $\$\ 1032 \times \frac{3}{8} = 387£.$ Ans.

9. $12£.\ 12s. = 12.6£.$
$12.6£. \div \frac{7}{50} = \$\ 54$ Ans.

10. $\$\ 54 \times \frac{7}{50} = £\ 12.6$
$.6 \times 20 = $ s. 12.
$12£.\ 12s.$ Ans.

11.

12	6.
20	18.5

$£\ 128.925$
$128.925£. \div \frac{1}{4} = \$\ 515.70$ Ans.

12. $\$\ 515.70 \times \frac{1}{4} = £\ 128.925$
$.925 \times 20 = $ s. 18.5
$.5 \times 12 = $ d. 6.0
$128£.\ 18s.\ 6d.$ Ans.

SECTION XXX.

CIRCULATING DECIMALS.

CASE I.

2. (p. 153.) $.\dot{3} = \frac{3}{9} = \frac{1}{3}$ Ans.
3. $1.6\dot{2} = 1.62\dot{1} = 1\frac{621}{999} = 1\frac{23}{37}$ Ans.
4. $.\dot{7}69230\dot{7} = \frac{769230}{999999} = \frac{10}{13}$ Ans.

CASE II.

2. (p. 154.) $.5\dot{3} = \frac{5}{10} + \frac{3}{90} = \frac{8}{15}$ Ans.
3. $.5\dot{9}2\dot{5} = \frac{5}{10} + \frac{925}{9990} = \frac{5820}{9990} = \frac{16}{27}$ Ans.
4. $.00849713\dot{3} = \frac{8}{1000} + \frac{497133}{9999990000} = \frac{83}{9760}$ Ans.
5. $31.6\dot{2} = 31.62\dot{1} = 31\frac{621}{999} = 31\frac{23}{37}$ Ans.

CASE III.

2. (p. 155.) $3.\dot{6}7\dot{1} = 3.671671671\dot{6}7\dot{1}$; $1.\dot{0}07\dot{1} = 1.\dot{0}07100710071\dot{0}7\dot{1}$; $8.5\dot{2} = 8.52525252525\dot{2}$; $7.\dot{6}16325 = 7.\dot{6}16325616325$ Ans.

3. $1.5\dot{2} = 1.525252$; $8.\dot{7}156 = 8.71567\dot{1}$; $3.56\dot{7} = 3.567777$; $1.3\dot{7}8 = 1.378787$ Ans.

4. $.000\dot{7} = .000707070\dot{7}$; $.14\dot{1}4\dot{1}4 = .141414\dot{1}4\dot{1}4$; $887.\dot{1} = 887.111\dot{1}11111\dot{1}$ Ans.

CASE IV.

3. (p. 156.) As the denominator 11 cannot be divided by 2, 5, or 10, the decimal is infinite. Then, $^{11)2}\frac{2}{9}$. As two 9's are used, the circulate will consist of two places; thus, $^{11)1.00}_{\dot{0}\dot{9}}$ Ans.

4. $^{253)99}_{39525691699604743083}\frac{000000000000000000000000}{}$. As twenty-two 9's are necessary to complete the division without a remainder, so we infer that the repetend will consist of twenty-two places; thus, $\frac{107}{253} = .\dot{4}22924901185770750988\dot{1}$ Ans.

SECTION XXXI.

ADDITION OF CIRCULATING DECIMALS.

2. (p. 157.)

$27.5\dot{6} = 27.5\dot{6}75675675675\dot{6}$
$5.6\dot{3}2\dot{2} = 5.6\dot{3}26326326326\dot{3}2\dot{6}$
$6.\dot{7} = 6.\dot{7}777777777777\dot{7}$
$16.35\dot{6} = 16.3\dot{5}65656565656\dot{5}$
$.7\dot{1} = .7\dot{1}1111111111\dot{1}$
$6\ \dot{1}234\dot{1} = 6.1\dot{2}34123412341\dot{2}$
Ans. $63.1\dot{6}90670868888\dot{8}$

3.

$2.76\dot{5} = 2.76\dot{5}65\dot{5}$
$7.1\dot{6}67\dot{4} = 7.1\dot{6}67\dot{4}$
$3.67\dot{1} = 3.67136\dot{6}$
$.\dot{7} = .\dot{7}7777\dot{7}$
$.1\dot{7}2\dot{8} = .1\dot{7}28\dot{1}$
Ans. $14.5\dot{5}43\dot{6}$

4.

$5.1\dot{6}345\dot{5} = 5.1\dot{6}3451634516345\dot{1}6345\dot{5}$
$8.6\dot{3}8\dot{1} = 8.6\dot{3}8163816381638163816\dot{3}8\dot{1}$
$3.7\dot{5} = 3.\dot{7}5757575757575757\dot{5}7\dot{5}$
Ans. $17.\dot{5}5919120847374090302\dot{5}$

5.

$\frac{1}{6} = .\dot{1}\dot{6} = .\dot{1}666\dot{6}$
$\frac{1}{7} = .\dot{1}42857 = .\dot{1}42857$
$\frac{1}{9} = .\dot{1} = .\dot{1}111\dot{1}$
Ans. $.\dot{5}8730\dot{1}$

SECTION XXXII.

SUBTRACTION OF CIRCULATING DECIMALS.

2. (p. 158.)

$7.\dot{1} = 7.1\dot{1}$
$5.0\dot{2} = 5.0\dot{2}$
Ans. $2.0\dot{8}$

3.

$315.\dot{8}\dot{7} = 315.\dot{8}75875875875$
$78.0\dot{3}7\dot{8} = 78.037803780378$
Ans. $237.\dot{8}38072095497$

4.

$\frac{2}{9} = .\dot{2} = .222222$
$\frac{1}{7} = .\dot{1}42857 = .142857$
Ans. $.0\dot{7}9365$

5.

$16.134\dot{7} = 16.1347$
$11.08\dot{8}\dot{4} = 11.0884$
Ans. $5.046\dot{2}$

6.

$18.167\dot{8} = 18.1678$
$3.2\dot{2}\dot{7} = 3.2727$
Ans. $14.895\dot{1}$

7.

$3.\dot{1}2\dot{3} = 3.\dot{1}23123$
$.7\dot{1} = .71717\dot{1}$
Ans. $2.40595\dot{1}$

8.

$\frac{3}{7} = .\dot{4}28571 = .428571$
$\frac{2}{11} = .\dot{1}\dot{8} = .181818$
Ans. $.2467\dot{5}\dot{3}$

9.

$\frac{4}{9} = .\dot{4} = .444444$
$\frac{2}{7} = .2\dot{8}5714 = .285714$
Ans. $.1587\dot{3}0$

10.

$\frac{8}{17} = .\dot{4}7058823$
$\frac{6}{17} = .3529411764705882$
Ans. $.\dot{1}764705882352941$

11.

$5.\dot{1}2345 = 5.1\dot{2}345123451234512345123451234\dot{5}1\dot{5}\dot{1}$
$2.3523456\dot{6} = 2.3523456523456523456523456523456\dot{6}$

Ans. $2.771105582166692777798888859999\dot{4}$

SECTION XXXIII.

MULTIPLICATION OF CIRCULATING DECIMALS.

(p. 159.)

3.

$87.32\dot{5}8\dot{6}$
437

61128106
26197759_7
$3493034\dot{6}_{34}$

Ans. $381.6140338\dot{8}$

4. $3.14\dot{5} = 3.1\frac{4}{99} = 3.1\frac{5}{11}$; $= \frac{348}{110}$; $4.2\dot{9}7\dot{7} = 4\frac{297}{999} = 4\frac{11}{37} = \frac{152}{37}$; $\frac{348}{110} \times \frac{152}{37} = \frac{52014}{4070} = 13.5\dot{1}69533\dot{3}$ Ans.

5.

$.2857\dot{1}4$
28

2285714
571428_5

Ans. 8.000000

6.

$.461607\dot{1}42857$
20

$9\ 232142857\dot{1}4_2$
4

$0.928571\dot{4}28571$
28

7428571428571
1857142857142_8

Ans. 26.000000000000

7.

$$.\dot{2}8493150\dot{6}$$
$$365$$
$$1424657534$$
$$1709589041_0$$
$$854794520_{54}$$
$$\text{Ans. } 104.\dot{0}0000000\dot{0}$$

SECTION XXXIV.

DIVISION OF CIRCULATING DECIMALS.

2. (p. 159.) $345.\dot{8} = 345\frac{8}{9}$; $.\dot{6} = \frac{6}{9} = \frac{2}{3}$; $345\frac{8}{9} \div \frac{2}{3} = 518\frac{8}{6} = 518.8\dot{3}$ Ans.

3. $234.\dot{6} = 234\frac{6}{9}$; $.\dot{7} = \frac{7}{9}$; $234\frac{6}{9} \div \frac{7}{9} = 301\frac{5}{7} = 301.71\dot{4}285\dot{7}$ Ans.

4. $.3\dot{6} = \frac{36}{99} = \frac{12}{33}$; $.2\dot{5} = \frac{2}{10} + \frac{5}{90} = \frac{23}{90}$; $\frac{12}{33} \div \frac{23}{90} = \frac{12}{33} \times \frac{90}{23} = \frac{1080}{759} = 1.\dot{4}22924901185770750988\dot{1}$ Ans.

SECTION XXXV.

MENTAL OPERATIONS IN FRACTIONS.

2. (p. 160.)	$56\frac{1}{4}$	13.	$80\frac{3}{4}$	24.	6391
3.	$12\frac{1}{4}$	14.	$143\frac{3}{4}$	25.	9991
4.	$90\frac{1}{4}$	15.	$399\frac{3}{4}$	26.	391
5.	$132\frac{1}{4}$	16.	$8099\frac{3}{4}$	27.	\$396
6.	$420\frac{1}{4}$	18.	$63\frac{15}{16}$	28.	\$891
7.	$930\frac{1}{4}$	19.	$99\frac{24}{25}$	29.	\$35.84
9.	1225	20.	$80\frac{7}{16}$	30.	\$886
10.	7225	21.	$399\frac{99}{100}$	31.	\$2499
11.	9025	23.	6375		

SECTION XXXVI.

QUESTIONS TO BE PERFORMED BY ANALYSIS.

2. (p. 162.) $6.48 \div 72 = .09$; $675 \times .09 = \$60.75$ Ans.

3. $1 \div \frac{1}{8} = 8$; $29\frac{7}{8} \times 8 = 239$lbs. Ans.

4. $\$73.50 \div 63 = 1.16\frac{2}{3}$; 17hhd. 45gal. = 1116gal.; $1116 \times 1.16\frac{2}{3} = \$1302.00$ Ans.

5. $\$9.00 \div 11 = \$0.81\frac{9}{11}$; $.81\frac{9}{11} \times 25 = \$20.45\frac{5}{11}$ Ans.

6. $1620 \div 15 = 108$; $108 \times 27 = 2916$lbs. Ans.

7. $\$7.00 \div 9 = .77\frac{7}{9}$; $.77\frac{7}{9} \times 37\frac{11}{16} = \$29.31\frac{1}{4}$ Ans.

8. $8 \times 9 = 72$; $72 \div 23 = 3\frac{3}{23}$ weeks, Ans.

9. $7\frac{3}{12} = \frac{87}{12}$; $19\frac{1}{12} = \frac{239}{12}$; $\frac{318.50}{1} \times \frac{12}{87} = \frac{3822.00}{87}$; $\frac{3822.00}{87} \times \frac{239}{12} = \frac{913458.00}{1044} = \$874.95\frac{85}{87}$ Ans.

10. $\$\frac{25.00}{1} \times \frac{1}{2240} = \frac{2500}{2240} = \frac{125}{112}$; 17T. 13cwt. 0qr. 19lbs. = 39555lbs.; $\frac{39555}{1} \times \frac{125}{112} = \frac{4944375}{112} = \$441.46+$ Ans.

11. $9\frac{3}{4} = \frac{39}{4}$; $\frac{4}{39} \times \frac{25}{1} = \frac{100}{39} = 2\frac{22}{39}$ Ans.

12. $9\frac{3}{4} = \frac{39}{4}$; $\frac{39}{4} \times \frac{1}{25} = \frac{39}{100}$ Ans.

13. $7\frac{3}{8} = \frac{59}{8}$; $\frac{25}{1} \times \frac{8}{59} = \frac{200}{59}$; $\frac{97}{1} \times \frac{200}{59} = \frac{19400}{59} = \$328.81\frac{21}{59}$ Ans.

14. $\$47.25 \div 7 = \$6.75$; $\$6.75 \times 43 = \$290.25$ Ans.

15. $7\frac{1}{2} = \frac{15}{2}$; $1\frac{3}{4} = \frac{7}{4}$; $\frac{15}{2} \times \frac{4}{7} = \frac{60}{14} = 4\frac{2}{7}$yds. Ans.

16. $10 \times 7 = 70$; $70 \div 37 = 1\frac{33}{37}$ days, Ans.

17. $108 \div 9 = 12$; $12 \times 5 = 60$ calves, Ans.

18. $11 \div 5 = 2\frac{1}{5}$; $2\frac{1}{5} \times 3 = 6\frac{3}{5}$yds. Ans.

19. $18 \div 2 = 9$; $9 \times 7 = 63$ pairs, Ans.

20. $47 \div 7 = 6\frac{5}{7}$; $6\frac{5}{7} \times 4 = 26\frac{6}{7}$gals. Ans.

21. $377 \div 15 = 25\frac{2}{15}$; $25\frac{2}{15} \times 100 = 2513\frac{1}{3}$ miles, Ans.

22. $30 \times 12 = 360$; $360 \div 47 = 7\frac{31}{47}$ days, Ans.

23. $\$25.75 \div 5 = 5.15$; $5.15 \times 39 = \$200.85$ Ans.

24. 17A. = 2720p.; 98A. 3R. 14p. = 15814p. $\times$ $\$\frac{19101}{1} \times \frac{1}{2720} \times \frac{15814}{1} = \frac{1250903214}{2720} = \$4598.90,87\frac{6}{8}$ Ans.

25. $97\frac{3}{8} = \frac{779}{8}$; $\frac{2755.20}{1} \times \frac{8}{779} = \frac{22040}{779}$; $\frac{22040}{779} \times \frac{7}{1} = \frac{154280}{779} = \$19.78+$ Ans.

26. $97 \div 5 = 19\frac{2}{5}$; $19\frac{2}{5} \times 7 = 135\frac{4}{5}$ feet, Ans.

27. $3\frac{3}{7} = \frac{24}{7} \div 11 = \frac{24}{77}$; $\frac{24}{77} \times \frac{17}{1} = \frac{408}{77} = 5\frac{23}{77}$cwt. Ans.

28. $47\frac{3}{7} = \frac{332}{7}$; $3\frac{3}{7} = \frac{23}{7}$; $\frac{332}{7} \times \frac{7}{23} = \frac{2324}{161} = \frac{332}{23}$; 1w. = 7da.; 7da. = 168h.; $\frac{332}{23} \times \frac{168}{1} = \frac{55776}{23} = 2425\frac{1}{23}$ miles, Ans.

29. $10 \times 7 = 70$; $70 \div 12 = 5\frac{5}{6}$ days, Ans.

30. $\frac{11}{7} \times \frac{42.12}{1} \times \frac{4}{5} = \frac{1853.28}{35} = \$29.41\frac{5}{7}$ Ans.

31. $\frac{7}{4} \times \frac{10.27}{1} \times \frac{4}{1} = \frac{287.56}{4} = \$71.89$ Ans.

32. $18 \times 5 = 90$ days; $90 \div 6 = 15$ days. Ans.

33. $19 \div 25 = \frac{19}{25}$; $\frac{19}{25} \times \frac{71.25}{1} = \frac{1353.75}{25} = 54\frac{3}{20}$gal. Ans.

34. $1.00 \times 8 = \$8.00$; $\$8.00 \div 1.25 = 6\frac{2}{5}$oz. Ans.

35. $126 \div 7 = 18$ barrels, Ans.

36. $4\frac{1}{8} = \frac{33}{8}$; $1\frac{3}{8} = \frac{11}{8}$; $\frac{33}{8} \times \frac{11}{8} = \frac{363}{64}$; $\frac{363}{64} \div \frac{7}{8} = \frac{363}{64} \times \frac{8}{7} = \frac{2904}{448} = 6$yd. 1qr. $3\frac{5}{7}$na. Ans.

37. $4 \times 2 \times 1\frac{1}{2} = 12$; $8 \times 4 \times 3 = 96$; $300 \div 12 = 25$; $96 \times 25 = 2400$lbs. Ans.

38. $12\frac{4}{7} = \frac{88}{7}$; $160 \div \frac{88}{7} = \frac{160}{1} \times \frac{7}{88} = \frac{1120}{88} = 12\frac{8}{11}$rd. Ans.

39. $25\frac{21}{22} = \frac{571}{22}$; $\frac{571}{22} \times \frac{5280}{1} = \frac{3014880}{22}$; $\frac{3014880}{22} \div 1142 = \frac{3014880}{22} \times \frac{1}{1142} = \frac{3014880}{25124} = 120$ seconds $= 2$ minutes, Ans.

40. $\frac{7}{11} \times \frac{11}{14} = \frac{77}{154} = \frac{1}{2}$; $\$46.70 \div \frac{1}{2} = \frac{4670}{1} \times \frac{2}{1} = \$93.40$, Ans.

41. $\$97 \div 4 = \frac{97}{4}$; $\frac{97}{4} \times \frac{11}{1} = \frac{1067}{4} = \$266.75$ Ans.

42. $19 \div 50 = \frac{19}{50}$; $\frac{7}{1} \times \frac{19}{50} = \frac{1463}{50} = 29\frac{13}{50}$lbs. Ans.

43. $17\frac{8}{11} = \frac{190}{11}$; $4\frac{1}{4} = \frac{17}{4}$; $\frac{17}{4} \times \frac{11}{190} = \frac{187}{760}$ Ans.

44. 11s. 3d. = 135d.; 15s. = 180d.; $\frac{180}{135} = \frac{4}{3} = 1\frac{1}{3}$ Ans.

45. $7\frac{1}{4}$yd. = 29 quarters; $3\frac{3}{8}$ ells = 18 quarters; $18 \div 29 = \frac{18}{29}$ Ans.

SECTION XXXVII.

SIMPLE INTEREST.

CASE I.

3. (p. 165.)	$ 40.50	12.	$ 15.76,2
4.	$ 103.68	13.	$ 926.34
5.	$ 2.35,6	14.	$ 222.25
6.	$ 161.33	15.	$ 108.58,7
7.	$ 209.55	16.	$ 888.54,6
8.	$ 476.14,4	17.	$ 499.98,2
9.	$ 44.44,2	18.	$ 52.41,2
10.	$ 267.75	19.	$ 3.37,5
11.	$ 7.24,5	20.	$ 540.00

CASE II.

2. (p. 166.)	$ 31.85	9.	$ 1.08
3.	$ 116.99	10.	$ 1.14
4.	$ 40.10	11.	$ 11.77
5.	$ 45.08,6	12.	$ 5.79
6.	$ 238.63	13.	$ 41.79
7.	$ 4.58	14.	$ 193.09
8.	$ 286.31		

CASE III.

2. (p. 168.)	$ 74.91,5	10.	$ 0.23,6
3.	$ 26.34,3	11.	$ 2.70,1
4.	$ 0.73,9	12.	$ 17.43,8
5.	$ 217.93,2	13.	$ 0.86,6
6.	$ 0.58,4	14.	$ 297.51,8
7.	$ 1.69,9	15.	$ 179.10,6
8.	$ 20.16,6	16.	$ 2.59,6
9.	$ 3.22,7	17.	$ 0.12,0

CASE IV.

2. (p. 169.)

y.	mo.	d.	
1833	4	11	$786.75
1831	11	9	.085 1/3
1	5	2	393375
			629400
			26225

Ans. $67.13,600

3.

y.	mo.	d.	
1829	9	19	$98.25
1826	6	4	.197 1/2
3	3	15	68775
			88425
			9825
			4912 1/2

Ans. $19.40,437 1/2

4.

y.	mo.	d.	
1833	6	27	$76.89,5
1822	0	11	.692 2/3
11	6	16	153790
			692055
			461370
			51263 1/3

Ans. $53.26,2603 1/3

5.

y.	mo.	d.	
1830	6	18	$22.76,3
1806	1	19	1.464 5/6
24	4	29	91052
			136578
			91052
			22763
			18969 1/6

Ans. $33.34,4001 1/6

6.

y.	mo.	d.	
1832	4	5	$76.35
1830	7	17	.103
1	8	18	22905
			7635

Ans. $7.86,405

7.

y.	mo.	d.	
1828	11	19	$97.86
1821	4	17	.455 1/3
7	7	2	48930
			48930
			39144
			3262

Ans. $44.55,892

8.

y.	mo.	d.	
1826	5	18	$1728.75
1823	10	19	.154 1/6
2	6	29	691500
			864375
			172875
			144062 1/2

Ans. $267.66,812 1/2

9.

y.	mo.	d.	
1832	1	29	$999.99,9
1800	0	1	1.929 1/3
32	1	28	899991
			199998
			899991
			99999
			66666

Ans. $192.96,4737

10.

y.	mo.	d.	
1822	5	17	$16.76
1811	11	17	.63
10	6	0	5028
			10056

Ans. $10.55,88

11.

y.	mo.	d.	
1833	11	15	$35.61
1831	10	11	.125 2/3
2	1	4	17805
			7122
			3561
			2274

Ans. $4.47,399

12.

y.	mo.	d.	
1831	7	17	$786.97
1827	9	19	.229 2/3
3	9	28	708273
			157394
			157394
			52464 2/3
			$180.74,077 2/3
			7 1/2
			126518539
			9037038 5/6
			6)1355,555775/6

Ans. $225.92,596 11/36

13.

y.	mo.	d.	
1832	6	3	$96.84
1829	10	27	.156
2	7	6	58104
			48420
			9684
			$15.10,704

(Carried up.)

(Brought up.)

$15.10,704
7 1/2
10574928
755352
6)11330280

Ans. $18.88,380

14.

y.	mo.	d.	
1832	11	7	$11.10,5
1832	3	17	.038 1/3
	7	20	88840
			33315
			3701 2/3
			$.42,5691 2/3
			7
			6)2979841 2/3

Ans. $0.49,6640 5/18

15.

y.	mo.	d.	
1819	5	17	$117.21
1806	5	19	.779 2/3
12	11	28	105489
			82047
			82047
			7814
			$91.38,473
			8 1/2
			73107784
			4569236 1/2
			6)776770201/2

Ans. $129.46,170 1/12

16.

y.	mo.	d.	
1832	0	11	$1786 9.75
1830	1	7	.115 2/3
1	11	4	8934875
			1786975
			1786975
			1191316 2/3
			$2066.93,441 2/3
			5
			6)10334672081/3
			Ans. $1722.44,534 13/18

17.

y.	mo.	d.	
1827	5	19	$71.09,1
1823	6	29	.233 1/3
3	10	20	213273
			213273
			142182
			23697
Interest at 6 per cent.*			$16.58,7900
			2
			Ans. $33.17,5800

* The interest will be twice this amount at 12 per cent.

18.

y.	mo.	d.	
1833	6	11	$83.47
1830	10	8	.160 1/2
2	8	3	500820
			8347
			4173 1/2
			$13.39,693 1/2
			8 3/4
			10717548
			1004770 1/8
			6)11722318 1/8
			Ans. $19.53,719+

19.

y.	mo.	d.	
1833	6	17	$79.25
1831	11	8	.096 1/2
1	7	9	47550
			71325
			3962 1/2
			Ans. $7.64,762 1/2

20.

y.	mo.	d.	
1829	9	12	$175.07
1825	0	7	.285 5/8
4	9	5	87535
			140056
			35014
			14589 1/8
			Ans. $50.04,084 1/8

21.

y.	mo.	d.	
1833	7	20	$12.75
1831	5	16	.130 3/3
2	2	4	38250
			1275
			850
			Ans. $1.66,600

22.

y.	mo.	d.	
1834	0	11	$197.28,5
1832	11	6	.065 5/8
1	1	5	986425
			1183710
			164404 1/8
			Ans. $12.98,7929 1/8

23.

y.	mo.	d.
1834	7	30
1833	0	2
1	7	28

$12.69
.099 2/3
11421
11421
846
$1.26,477
7
6)885339
Ans. $1.47,556 1/2

24.

y.	mo.	d.
1833	5	10
1831	1	11
2	3	29

$79.15
.139 5/6
71235
23745
7915
6595 5/6
$11.06,780 5/6
7 1/4
7747465 5/6
276695+
6)8024160+
Ans. $13.37,360

25.

y.	mo.	d.
1833	0	1
1831	2	11
1	9	20

$83.33
.108 1/3
66664
8333
2777 2/3
$9.02,741 2/3
7 1/2
6319187
451370 5/6
6)67705577/8
11.28,426
8333
Ans. $94.61,426

26.

y.	mo.	d.
1831	5	1
1831	2	2
2	29	

$100.25
.014 5/6
40100
10025
8354 1/6
$1.48,704 1/6
4
6)594816 2/3
.99,136+
100.25
Ans. $101.24,136

27.

y.	mo.	d.
1832	6	31
1830	3	30
2	3	1

$369.29
.135 1/6
184645
110787
36929
6154 5/6
$49.91,569 5/6
9
6)449241281/2
74.87,354
369.29
Ans. $444.16,354

28.

y.	mo.	d.
1835	5	17
1830	0	1
5	5	16

$769.87
.327 2/3
538909
153974
230961
51324 2/3
$252.26,073 2/3
9 1/2
2270346 63
12613036+
6)239647699+
Ans. $399.41,283+

29.

y.	mo.	d.
1833	5	29
1833	0	11
	5	18

$69.75
.028
55800
13950
195300
17½
1367100
1953
97650
6)3417750
Ans. $5.69,625

30.

y.	mo.	d.
1835	5	19
1816	3	2
19	2	17

$368.18
1.152⅝
73636
184090
36818
36818
30681⅔
2 per cent. = ⅓ of 6; hence 3)424.45,077⅔
Ans. $141.48,359+

31.

y.	mo.	d.
1833	11	6
1831	2	3
2	9	3

$16.16
.165½
8080
9696
1616
808
6)2.67,448
Ans. $0.44,574⅔

32.

y.	mo.	d.
1830	6	17
1824	4	7
6	2	10

$1728.19
.371⅔
172819
1209733
518457
115212⅔
4×6=24)642.31,061⅔
Ans. $26.76,294+

33.

y.	mo.	d.
1833	5	30
1831	11	29
1	6	1

$397.16
.090⅙
3574440
66191⅓
35810591⅓
5½
179052962⅔
1790529
6)19695825
Ans. $32.82,637

34.

y.	mo.	d.
1832	11	19
1831	1	17
1	10	2

$1760.07
.110⅓
1760070
1760070
58669
2×6=12)194.19,439
$16.18,286+
1760.07
Ans. $1776.25,286

35. First find the interest on the shoes from the time they

become due until the time of settlement; add this interest to the value of the shoes.

$ 865 × 1.068$\frac{5}{6}$ = $ 924.54; $ 386.27 × 1.063$\frac{2}{3}$ = $ 410.86; $ 769.25 × 1.056$\frac{2}{3}$ = $ 812.84; $ 183.75 × 1.047$\frac{1}{2}$ = $ 192.44; $ 396.81 × 1.043$\frac{1}{3}$ = 414.00.
$ 924.54 + $ 410.86 + $ 812.84 + $ 192.44 + $ 414.00 = $ 2754.68, amount of the shoes.

Then find the amount of the sums G. K. M. has received, from the time when received to the time of settlement.

$ 1000 × 1.061$\frac{1}{3}$ = 1061.33; $ 375.25 × 1.053$\frac{1}{3}$ = $ 395.26; $ 681.29 × 1.049 = $ 714.67; $ 100 × 1.045$\frac{1}{6}$ = $ 104.51; $ 275.28 × 1.029$\frac{1}{2}$ = $ 283.40.
$ 1061.33 + $ 395.26 + $ 714.67 + $ 104.51 + $ 283.40 = $ 2559.17, amount of the sums received.
$ 2754.68 — $ 2559.17 = $ 195.51 Ans.

CASE V.

1. (p 172.)	$ 10.55,7	7.	$ 7.96
2.	$ 4.48,5	8.	$ 75.30,8
3.	$ 0.18,2	9.	$ 0.73
4.	$ 1.99	10.	$ 0.85,3
5.	$ 20.66,2	11.	$ 2.85
6.	$ 3.28,7	12.	$ 1784.81

SECTION XXXVIII.

PARTIAL PAYMENTS.

2. (p. 173.)

Principal, ...	$ 700.00.0
Interest from Feb. 4 to Nov. 28, 9mo. 24da. . .	34.30.0
Amount carried forward, ...	$ 734.30.0

Amount brought forward, ...		$734.30.0
First payment, ...	160.00.0	
Interest from March 18 to Nov. 28, 8mo. 10da.	6.66.6	
Second payment, ...	200.00.0	
Interest from June 24 to Nov. 28, 5mo. 4da.	5.13.3	
Third payment, ...	120.00.0	
Interest from Sept. 11 to Nov. 28, 2mo. 17da.	1.54.0	
Fourth payment, ...	60.00.0	
Interest from Oct. 5 to Nov. 28, 1mo. 23da.	.53.0	
		553.86.9
Balance remaining due Nov. 28, 1834, . . .		**$180.43.1**

3.

Principal, bearing interest from Aug. 16, 1834,		$600.00.0
Interest from Aug. 16, 1834, to Aug. 1, 1835, 11mo. 15da.		34.50.0
Amount, ...		634.50.0
First payment, Sept. 18, 1834, . . .	136.00.0	
Interest from Sept. 18, 1834, to Aug. 1, 1835, 10mo. 13da.	7.09.4	
Second payment, Dec. 5, 1834, . . .	197.00.0	
Interest from Dec. 5, 1834, to Aug. 1, 1835, 7mo. 26da.	7.74.8	
Amounts carried forward,	$347.84.2	$634.50.0

Amounts brought forward,	$347.84.2	$634.50.0
Third payment, Feb. 11, 1835, . . .	200.00.0	
Interest from Feb. 11, 1835, to Aug. 1, 1835, 5mo. 20da.	5.66.6	
Fourth payment, April 19, 1835, . .	40.00.0	
Interest from April 19, 1835, to Aug. 1, 1835, 3mo. 12da.	.68.0	
		594.18.8
Balance remaining due Aug. 1, 1835, ...		$40.31.2

5.

Principal, on interest from June 17, 1829, . .	$769.87.0
Interest from June 17, 1829, to March 1, 1830, 8mo. 14da.	32.59.1
Amount, ...	802.46.1
First payment, March 1, 1830, ...	75.50.0
New principal, bearing interest from Mar. 1, 1830,	726.96.1
Interest from March 1, 1830, to June 11, 1831, 15mo. 10d.	55.73.3
Amount, ...	782.69.4
Second payment, June 11, 1831, ...	165.00.0
New principal, bearing interest from June 11, 1831,	617.69.4
Interest from June 11, 1831, to Sept. 15, 1831, 3mo. 4da.	9.67.7
Amount, ...	627.37.1
Third payment, Sept. 15, 1831, ...	161.00.0
New principal, bearing interest from Sept. 15, 1831, carried forward, ...	$466.37.1

Amount brought forward, . . .		$466.37.1
Interest from Sept. 15, 1831, to Jan. 21, 1832, 4mo. 6da.		9.79.3
Amount, ...		476.16.4
Fourth payment, January 21, 1832, ...		47.25.0
New principal, bearing interest from Jan. 21, 1832,		428.91.4
Interest from Jan. 21, 1832, to Dec. 6, 1833, 22mo. 15da.		48.25.2
Amount, ...		477.16.6
Fifth payment, less than interest, March 5, 1833, ...	12.17	
Sixth payment, more than interest, Dec. 6, 1833, ...	98.00	
		110.17.0
New principal, bearing interest from Dec. 6, 1833,		366.99.6
Interest from Dec. 6, 1833, to July 7, 1834, 7mo. 1d.		12.90.6
Amount, ...		379.90.2
Seventh payment, July 7, 1834, ...		169.00.0
New principal, bearing interest from July 7, 1834,		210.90.2
Interest from July 7, 1834, to Sept. 25, 1835, 14mo. 18da.		15.39.5
Balance due Sept. 25, 1835, ...		$226.29.7

6.

Principal, on interest from April 30, 1831, . .	$300.00.0
Interest from April 30, 1831, to June 27, 1832, 13mo. 27da.	20.85.0
Amount carried forward, . . .	$320.85.0

Amount brought forward, . . .	$320.85.0
First payment, June 27, 1832, ...	150.00.0
New principal, bearing interest from June 27, 1832,	170.85.0
Interest from June 27, 1832, to Dec. 9, 1832, 5mo. 12da.	4.61.2
Amount, ...	175.46.2
Second payment, Dec. 9, 1832, ...	150.00.0
New principal, bearing interest from Dec. 9, 1832,	25.46.2
Interest from Dec. 9, 1832, to Oct. 9, 1833, 10mo.	1.27.3
Balance due Oct. 9, 1833, ...	$26.73.5

7.

Principal, on interest from Feb. 11, 1832, . . .		$54.18.0
Interest from Feb. 11, 1832, to July 11, 1833, 17mo.		4.60.5
Amount, ...		58.78.5
First payment, July 11, 1833, ...		12.25.0
Principal, bearing interest from July 11, 1833, .		46.53.5
Interest from July 11, 1833, to Aug. 21, 1835, 25mo. 10da.		5.89.4
Amount, ...		52.42.9
Second payment, less than interest, Aug. 15, 1834, ...	2.10.0	
Third payment, less than interest, July 9, 1835, ...	3.12.0	
Amounts carried forward, .	$5.22.0	$52.42.9

Amounts brought forward, .	$5.22.0	$52.42.9
Fourth payment, more than interest, Aug. 21, 1835, ...	37.18.0	42.40.0
Principal, bearing interest from Aug. 21, 1835,		10.02.9
Interest from Aug. 21, 1835, to Dec. 17, 1835, 3mo. 26da.		.19.3
Balance due, Dec. 17, 1835, ...		$10.22.2

8.

Principal, on interest from Jan. 7, 1831, . .	$1728.00.0
Interest from Jan. 7, 1831, to Feb. 9, 1832, 13mo. 2da.	112.89.6
Amount, ...	1840.89.6
First payment, Feb. 9, 1832, ...	760.28.5
Principal, bearing interest from Feb. 9, 1832, .	1080.61.1
Interest from Feb. 9, 1832, to Dec. 28, 1833, 22mo. 19da.	122.28.9
Amount, ...	1202.90.0
Second payment, less than interest, Mar. 5, 1833, ... 68.50	
Third payment, more than interest, Dec. 28, 1833, ... 876.28	944.78.0
Principal, bearing interest from Dec. 28, 1833, .	258.12.0
Interest from Dec. 28, 1833, to July 17, 1834, 6mo. 19da.	8.56.0
Amount carried forward, ...	$266.68.0

Amount brought forward, . . .	$266.68.0
Fourth payment, July 17, 1834, ...	60.00.0
Principal, bearing interest from July 17, 1834, .	206.68.0
Interest from July 17, 1834, to Oct. 1, 1834, 2mo. 14da.	2.54.9
Balance due Oct. 1, 1834, ...	$209.22.9

9.

Principal, on interest from May 7, 1829, . .	$500.00.0
Interest from May 7, 1829, to June 29, 1830, 13mo. 22da.	34.33.3
Amount, ...	534.33.3
First payment, June 29, 1830, ...	100.00.0
New principal, carrying interest from June 29, 1830, ...	434.33.3
Interest from June 29, 1830, to Dec. 5, 1831, 17mo. 6da.	37.35.2
Amount, ...	471.68.5
Second payment, Dec. 5, 1831, ...	100.00.0
New principal carrying interest from Dec. 5, 1831,	371.68.5
Interest from Dec. 5, 1831, to July 4, 1833, 18mo. 29da.	35.24.8
Amount, ...	406.93.3
Third payment, March 12, 1832, less than interest, ... 5.00	
Fourth payment, July 4, 1833, more than interest, ... 95.00	
	100.00.0
New principal, carrying interest from July 4, 1833, carried forward, ...	$306.93.3

Amount brought forward, . . .	$306.93.3
Interest from July 4, 1833, to Dec. 1, 1834, 16mo. 27da.	25.93.6
Amount, ...	332.86.9
Fifth payment, Dec. 1, 1834, ...	200.00.0
New principal, carrying interest from Dec. 1, 1834,	132.86.9
Interest from Dec. 1, 1834, to Jan. 1, 1836, 13mo.	8.63.6
Balance due Jan. 1, 1836, ...	$141.50.5

10.

Principal, on interest from March 19, 1831, . .	$89.75.0
Interest from March 19, 1831, to Dec. 6, 1831, 8mo. 17da.	3.84.4
Amount, ...	93.59.4
First payment, Dec. 6, 1831, ...	12.12.0
New principal, bearing interest from Dec. 6, 1831,	81.47.4
Interest from Dec. 6, 1831, to Feb. 17, 1832, 2mo. 11da.	.96.4
Amount, ...	82.43.8
Second payment, Feb. 17, 1832, ...	12.12.0
New principal, bearing interest from Feb. 17, 1832, ...	70.31.8
Interest from Feb. 17, 1832, to Jan. 1, 1835, 34mo. 14da.	12.11.8
Amount carried forward, ...	$82.43.6

Amount brought forward, ...		$82.43.6
Third payment, March 19, 1833, less than interest, ...	3.16	
Fourth payment, Dec. 28, 1834, less than interest, ...	2.18	
Fifth payment, Jan. 1, 1835, more than interest, ...	25.25	
		30.59.0
New principal, bearing interest from Jan. 1, 1835,		51.84.6
Interest from Jan. 1, 1835, to March 11, 1835, 2mo. 10da.		.60.4
Amount, ...		52.45.0
Sixth payment, March 11, 1835, ...		31.18.0
New principal, bearing interest from Mar. 11, 1835,		21.27.0
Interest from March 11, 1835, to July 17, 1835, 4mo. 6da.		44.6
Amount, ...		21.71.6
Seventh payment, July 17, 1835, ...		5.18.0
New principal, bearing interest from July 17, 1835,		16.53.6
Interest from July 17, 1835, to Sept. 1, 1835, 1mo. 14da.		.12.1
Amount, ...		16.65.7
Eighth payment, Sept. 1, 1835, ...		6.29.0
New principal, bearing interest from Sept. 1, 1835,		10.36.7
Interest from Sept. 1, 1835, to Dec. 29, 1835, 3mo. 28da.		.20.3
Balance due Dec. 29, 1835, ...		$10.57.0

II.

Principal carrying interest from Jan 1, 1840, .		$ 1000.00
Interest from Jan. 1, 1840, to Sept. 28, 1840, 8mo. 27da.		51.91
Amount, ...		1051.91
First payment, ...		144.00
Balance for new principal, ...		907.91
Interest from Sept. 28, 1840, to July 17, 1841, 9mo. 18da.		51.01
Amount, ...		958.92
Second payment, March 1, 1841, a sum less than interest, ...	$ 20.00	
Third payment, July 17, 1841, a sum greater than interest, ...	360.00	380.00
Balance for new principal, ...		578.92
Interest from July 17, 1841, to Aug. 9, 1841, 20da.		2.47
Amount, ...		581.39
Fourth payment, Aug 9, 1841, ...		190.00
Balance for new principal, ...		391.39
Interest from Aug. 9, 1841, to Sept. 25, 1842, 1y. 1mo. 16da.		30.89
Amount, ...		422.28
Fifth payment, Sept. 25, 1842, ...		170.00
Balance for new principal, ...		252.28
Interest from Sept. 25, 1842, to Dec. 11, 1843, 1y. 2mo. 16da.		21.38
Amount, ...		273.66
Sixth payment, Dec. 11, 1843, ...		200.00
Balance for new principal, carried forward, . . .		73.66

Amount brought forward, ...	$ 73.66
Interest from Dec. 11, 1843, to July 4, 1845, 1y. 6mo. 23da.	8.06
Amount, ...	81.72
Seventh payment, July 4, 1845, ...	75.00
Balance for new principal, ...	6.72
Interest from July 4, 1845, to June 1, 1847, 1y. 10mo. 27da.	.89
Balance due at the time of payment, ...	$ 7.61

NOTE. — Interest on the above note is computed at 7 per cent.

SECTION XXXIX.

MISCELLANEOUS PROBLEMS IN INTEREST.

2. (p. 181.) $ 120 × .01 = 1.20 × $1\frac{1}{3}$ = 1.60; 133.20 — 120 = 13.20 ÷ 1.60 = $8\frac{1}{4}$ per cent. Ans.
3. $ 280 × .01 = 2.80 × $6\frac{1}{2}$ = 18.20; 411.95 — 280 = 131.95 ÷ 18.20 = $7\frac{1}{4}$ per cent. Ans.
5. $ 120 × .$08\frac{1}{4}$ = 9.90; 133.20 — 120 = 13.20 ÷ 9.90 = $1\frac{1}{3}$y. = 16 months, Ans.
6. $ 280 × .$07\frac{1}{4}$ = 20.30; 411.95 — 280 = 131.95 ÷ 20.30 = $6\frac{1}{2}$ years, Ans.
8. $ 1.00 × .$08\frac{1}{4}$ = .0825 × $1\frac{1}{3}$ = .11; 13.20 ÷ .11 = $ 120.00 Ans.
9. .$07\frac{1}{4}$ = .0725 × $6\frac{1}{2}$ = .47125 + 1 = 1.47125; 411.95 ÷ 1.47125 = $ 280.00 Ans.

SECTION XL.

COMPOUND INTEREST.

2. (p. 183.)

500
.06
30.00
500
530
.06
31.80
530
561.80
.06
33.7080
561.80
$595.5080 Ans.

24.6540
410.90
435.554
.06
26.13324
435.554
461.687
.06
27.70122
461.687
489.388
.06
29.36328
489.388
518.751
.06
31.12506
518.751
549.876
.06
32.99256

3.

345
.06
20.70
345
365.70
.06
21.9420
365.70
387.642
.06
23.25852
387.642
410.900
.06

(Brought up.)
32.99256
549.876
582.868
.06
34.97206
582.868
617.840
345.
$272.84 Ans.

4.

316
.06
18.96
316
334.96
.06
20.0976
334.96
355.057
.06
21.30342
355.057
376.360
.023
1129080
752720
8.656280
376.36
385.016
316.
$69.01 Ans.

6.

5.743491 = Amount of $1 for 30 years.
890

51691419
45947928
5111.70699
890
$4221.70,6 Ans.

7.

10.285717 = Amount of $1
480 [for 40 years.

82285736
41142868
$4937.14,416 Ans.

8.

1.790847 = Amount of $1 for 10 years.
.037½ = Ratio for 7 months 15 days.

12535929
5372541
895423
.067156762
1.790847
1.858003762
300
557.40,11286
300
$257.40,1 Ans.

9.

1.795856 = Amount of $1 for 12 years.
.009⅛ = Ratio for 1 month 29 days at
[6 per cent.

16162704
1496545
⅛) .017659249
2943208
.014716041
1.795856
1.810572041 = Amount at 5 per cent.
586

10863432246
14484576328
9052860205
$1060.99,5,216026 Ans.
9

10.

4) 2,500,000
625,000
4) 3,125,000
781,250
4) 3,906,250
976,562
4) 4,882,812
1,220,703
4) 6,103,515
1,525,878
4) 7,629,393
1,907,348
4) 9,536,741
2,384,185
4) 11,920,926
2,980,231
4) 14,901,157
3,725,289
4) 18,626,446
4,656,611
23,283,057 Ans.

We add to the principal one fourth of its sum, because 25 per cent. is one fourth of the principal.

11.

2,500,000
.02
50,000. Ans.

12.

1.407100
900
$1266.39 Ans.

13.

1.191016 = Amount of $1 for 3 years.
.019 = Ratio for 3 months, 24 days.
10719144
1191016
.022629304
1.191016
1.213645304 = Amount of $1 for 3 years, 3 [months, 24 days.
350
606822652 00
364093591 2
424.7758564 00
350.
$74.77,5+ = Compound interest of the principal for [do.

14.

1.1 2 3 6 = Amount of $ 1 for 2 years.
.0 4 9 = Ratio for 9 months and 24 days.

1 0 1 1 2 4
4 4 9 4 4
.0 5 5 0 5 6 4
1.1 2 3 6
1.1 7 8 6 5 6 4 = Amount of $ 1 for 2y. 9mo. 24d.
9 7 0
8 2 5 0 5 9 4 8 0
1 0 6 0 7 9 0 7 6
1 1 4 3.2 9 6 7 0 8
9 7 0.
$ 1 7 3.2 9,6 Ans. = Compound interest of the principal for do.

15.

Principal, bearing interest from Jan. 1, 1830, .		$ 500.00,0
Compound interest on $ 500 from Jan. 1, 1830, to Sept. 1, 1834, 4y. 8mo.		156.48,7
Amount of the principal to Sept. 1, 1834, . . .		656.48,7
First payment, July 16, 1830, . . .	$ 200.00,0	
Compound interest from July 16, 1830, to Sept. 1, 1834, 4y. 1mo. 15d. . .	54.38,8	
Second payment, Aug. 21, 1831, . .	200.00,0	
Compound interest from Aug. 21, 1831, to Sept. 1, 1834, 3y. 0mo. 10d. . .	38.59,9	
Third payment, Dec. 1, 1832, . . .	100.00,0	
Compound interest from Dec. 1, 1832, to Sept. 1, 1834, 1y. 9mo. . . .	10.77,0	
Amount of the indorsements, ...		603.75,7
Balance due Sept. 1, 1834, ...		$ 52.73,0

16.

Principal, bearing interest from March 25, 1834,		$ 100.00,0
Interest for 1y. 5mo.		8.65,0
Amount of the principal to Aug. 25, 1835, . . .		108.65,0
First payment, June 11, 1834, . . .	$ 50.00,0	
Compound interest from June 11, 1834, to Aug 25, 1835, 14mo. 14d. . .	3.65,3	
Second payment, Sept. 25, 1834, . .	50.00,0	
Compound interest from Sept. 25, 1834, to Aug. 25, 1835, 11mo.	2.75,0	
Amount of the indorsements, ...		106.40,3
Balance due Aug. 25, 1835, ...		$ 2.24,7

17.

Principal, bearing interest from Jan. 1, 1840, .		$ 1000.00
Compound interest on $ 1000 from Jan. 1, 1840, to April 1, 1845, 5y. 3mo.		427.09
Amount of principal to April 1, 1845, ...		1427.09
First payment, June 10, 1840, ...	$ 70.00	
Compound interest from June 10, 1840, to April 1, 1845, 4y. 9mo. 21d. . . .	26.94	
Second payment, Sept. 25, 1841, . . .	80.00	
Compound interest from Sept. 25, 1841, to April 1, 1845, 3y. 6mo. 6d. . . .	21.54	
Third payment, July 4, 1842, ...	100.00	
Compound interest from July 4, 1842, to April 1, 1845, 2y. 8mo. 27d. . . .	20.43	
Fourth payment, Nov. 11, 1843, . . .	30.00	
Compound interest from Nov. 11, 1843, to April 1, 1845, 1y. 4mo. 20d. . . .	2.97	
Amounts carried forward, .	$ 351.88	$ 1427.09

Amounts brought forward,	$ 351.88	$ 1427.09
Fifth payment, June 5, 1844, ...	50.00	
Compound interest from June 5, 1844, to April 1, 1845, 9mo. 26d.	2.87	
Amount of indorsements, ...		404.75
Balance due April 1, 1845, ...		$ 1022.34

NOTE. — The above note and indorsements are reckoned at 7 per cent.

18.

Principal, bearing compound interest at 5 per cent. from July 4, 1841, ...		$ 1700.00,0
Compound interest at 5 per cent. from July 4, 1841, to July 4, 1847, 6y.		578.16,0
Amount of the principal to July 4, 1847, . .		2278.16,0
Payment, Sept. 1, 1843, ...	$ 1000.00,0	
Compound interest at 5 per cent. from Sept. 1, 1843, to July 4, 1847, 3y. 10mo. 3d.	206.34,1	
Amount of the indorsement, ...		1206.34,1
Balance due July 4, 1847, ...		$ 1071.81,9

SECTION XLI.

DISCOUNT.

2. (p. 187.) $ 1.12 amount of $ 1 for the given time; $ 117.60 ÷ 1.12 = $ 105.00 Ans.
3. $ 1.07 amount of $ 1 for the given time; $ 802.50 ÷ 1.07 = $ 750; $ 802.50 — 750 = $ 52.50 Ans.
4. $ 1.205 amount of $ 1 for 3y. 5mo.; $ 769.60 ÷ 1.205 = $ 638.67,$2\frac{48}{241}$ Ans.
5. $ 1.46,$8\frac{1}{3}$ amount of $ 1 for 7y. 9mo. 20d.; $ 986.40 ÷ 1.46,$8\frac{1}{3}$ = $ 671.78,$2\frac{58}{361}$ Ans.

6. $\frac{16}{16}$ = amount, $\frac{15}{16}$ = principal, $\frac{1}{16}$ = discount. Therefore, $32 \times 16 = 512 \div 15 = 34\frac{2}{15}$qt. Ans.

7. $ 1.26875 amount of $ 1 for 3y. 7mo.; $ 678.75 ÷ 1.26875 = $ 534.97,5$\frac{75}{203}$ Ans.

8. $ 1.091$\frac{5}{8}$ amount of $ 1 for 18mo. 11d.; $ 1000 ÷ 1.091$\frac{5}{8}$ = $ 915.89$\frac{461}{651}$ Ans.

9. $ 1.017$\frac{2}{3}$ amount of $ 1 for 3mo. 16d.; $ 715.50 ÷ 1.017$\frac{2}{3}$ = $ 703.07,8$\frac{386}{303}$ Ans.

10. $ 1.054 amount of $ 1 for 10mo. 24d.; $ 914.75 ÷ 1.054 = $ 867.88,4$\frac{132}{527}$ Ans.

11. $ 1.056$\frac{5}{8}$ amount of $ 1 for 11mo. 11d.; $ 79.87 ÷ 1.056$\frac{5}{8}$ = $ 75.57,4+.

$ 1.111$\frac{1}{9}$ amount of $ 1 for 22mo. 7d.; $ 87.75 ÷ 1.111$\frac{1}{9}$ = $ 78.97,1 + $ 75.57,4 = $ 154.54,5+ Ans.

12. $ 1.250$\frac{1}{2}$ amount of $ 1 for 50mo. 3d.; $ 1728 ÷ 1.250$\frac{1}{2}$ = $ 1381.84,7$\frac{653}{2501}$ Ans.

13. $ 5.00 × 1.10 = $ 5.50; $ 1.00 — .10 = .90; 5.50 ÷ .90 = $ 6.11$\frac{1}{9}$ Ans.

14. $ 1.118 amount of $ 1 for 23mo. 18d.; $ 365.87 ÷ 1.118 = $ 327.25,4+.

$ 1.1525 amount of $ 1 for 30mo. 15d.; $ 161.15 ÷ 1.1525 = $ 139.82,6+.

$ 1.028$\frac{3}{4}$ amount of $ 1 for 5mo. 22d.; $ 112.50 ÷ 1.028$\frac{3}{4}$ = $ 109.36,4+.

$ 1.258 amount of $ 1 for 51mo. 18d.; $ 96.81 ÷ 1.258 = $ 76.95,5+.

$ 327.25,4 + $ 139.82,6 + $ 109.36,4 + $ 76.95,5+ = $ 653.40+ Ans.

SECTION XLII.

PER CENTAGE.

1. (p. 188.)	$ 1555.20.	3.	1296 barrels.
2.	$ 7.20.	4.	414 men.

5. $ 1468.80.
6. Wife, $ 10,000 ; son, $ 4,500 ; daughters, $ 3,480 each.
7. 75 bushels.
8. 15cwt.
9. 45 tons.
10. $ 375.
11. 665 chaldrons.
12. .8 miles.
13. $ 990.
14. 48 barrels.
15. 60 hogsheads.
16. $ 0 25.
17. 15.12 pounds.

SECTION XLIII.

COMMISSION AND BROKERAGE.

1. (p. 190.) $ 18,768 × .01¾ = $ 328.44 Ans.
2. $ 896 × .02 = $ 17.92 Ans.
3. 395£. 15s. 5d. × .02¼ = 8£. 18s. $1\frac{65}{400}$d. Ans.
4. $ 1976 × $\frac{100}{104}$ = $ 1900 Ans.
5. $ 7658.75 × .015 = $ 114.88⅛ Ans.
6. $ 107.75 × 37 = $ 3986.75 ; ⅜ per cent. = .00375 ; $ 3986.75 × .00375 = $ 14.95$\frac{1}{32}$ Ans.
7. $ 112.25 × 12 = $ 1347.00 ; ¼ per cent. = .0025 ; $ 1347.00 × .0025 = $ 3.36¾ Ans.
8. $ 12.25 × 700 = $ 8575.00 ; 1¾ per cent. = .0175 ; $ 8575.00 × .0175 = $ 150.06¼ Ans.
9. $ 8960.00 × $\frac{2}{102}$ = $ 175.68$\frac{272}{51}$ Ans.
10. $ 5.75 × 700 = $ 4025.00 ; 1¾ per cent. = .0175 ; $ 4025.00 × .0175 = $ 70.43¾ Ans.
11. $ 8.95 × 173 = $ 1548.35 ; 1⅞ per cent. = .01875 ; $ 1548.35 × .01875 = $ 29.03$\frac{5}{32}$ Ans.
12. 879£. 12s. 9d. × .03⅜ = 29£. 13s. $9\frac{511}{800}$d. Ans.
13. 987£. 18s. 6d. × .0225 = 22£. 4s. $6\frac{188}{200}$d. ; 987£. 18s. 6d. — 22£. 4s. $6\frac{188}{200}$d. = 965£. 13s. $11\frac{412}{200}$d. ; 965£. 13s. $11\frac{412}{200}$d. × 100 = 96569£. 13s. 4½d. ; 96569£. 13s. 4½d. ÷ 101⅞ = 947£. 18s. $5\frac{448}{815}$d. ; 947£. 18s. $5\frac{448}{815}$d.

÷ 1£. 3s. 8d. = 185413764 ÷ 231460 = 801$\frac{357}{578}\frac{6}{865}$ yards, Ans.

The pupil will perceive, that, in the latter part of the operation of this question, the pounds, shillings, and pence are reduced to 815ths of a penny.

14. $ 102.50 × 90 = $ 9225 ÷ 2½ = $ 3690, the sum remitted; $ 3690 — $ 90 = $ 3600 ÷ 95 = 37T. 17cwt. 3qr. 16$\frac{4}{19}$lb. Ans.

SECTION XLIV.

STOCKS.

2. (p. 191.) $ 100 × 15 = $ 1500 × 1.13 = $ 1695 Ans.
3. $ 100 × 12 = $ 1200 × 1.15 = $ 1380 Ans.
4. 1058£. 12s. × 1.15¾ = 1225£. 6s. 7$\frac{2}{5}$d. Ans.
5. $ 100 × 30 = $ 3000 × 1.08¾ = $ 3262.50 Ans.
6. $ 100 × 10 = $ 1000 × .85 = $ 850 Ans.
7. $ 100 × 5 = $ 500 × 1.07 = $ 535 Ans.

SECTION XLV.

INSURANCE AND POLICIES.

1. (p. 192.) 1¾ per cent. = .0175; $ 5728 × .0175 = $ 100.24 Ans.
2. 1¼ per cent. = .0125; $ 17,289 × .0125 = $ 216.11¼ Ans.
3. 4¾ per cent. = .0475; 3⅞ per cent. = .03875; $ 10,000 × .0475 = $ 475.00; $ 12,000 × .03875 = $ 465.00; $ 10,000 — $ 475 = $ 9,525; $ 12,000 — $ 465 = $ 11,535; $ 9,525 + $ 11,535 = $ 21,060; $ 50,765 — $ 21,060 = $ 29,705 Ans.
4. 4¼ + 3⅞ + 4⅜ + 5 + 5⅓ = 23⅜ per cent. = .23125; $ 47,600 × .23125 = $ 11,007.50 Ans.
5. $ 1728 × .0725 = $ 125.28 Ans.

6. $35,000 × ⅗ = $21,000; $21,000 × .0325 = $682.50; $75,000 × ⅔ = $50,000; $50,000 × .025 = $1250.00; $682.50 + $1250.00 = $1932.50 Ans.
7. $10,000 × .03375 = $337.50; $10,000 − $337.50 = $9962.50; $20,000 × .0475 = $950; $20,000 − $950 = $19,050; $18,750 + $37,960 = $56,710; $9962.50 + $19,050 = $28,712.50; $56,710 − $28,712.50 = $27,997.50 Ans.
8. $3675 × .04875 = $179.15⅝ Ans.
9. $896 × .12 = $107.52 Ans.
10. $850 × .18½ = $157.25 Ans.
11. $9870 × .07 = $690.90 Ans.
12. $1.00 − .15 = .85; $1728 × .85 = $1468.80 Ans.
13. $1.00 − .10 = .90; $2475 ÷ .90 = $2750 Ans.
14. $1.00 − .12½ = .87½; $26,250 ÷ .87½ = $30,000 Ans.
15. $3600 × .60 = $2160 Ans.
16. $1.00 − .10 = .90; $600 × .90 = $540 Ans.
17. $1.00 − .03 = .97; $1000 ÷ .97 = $1030.92,7+. $1.00 − .05 = .95; $1030.92,7 ÷ .95 = $1085.18,7+. $1.00 − .06 = .94; $1085.18,7 ÷ .94 = $1154.45,4+. $1.00 − .07 = .93; $1154.45,4 ÷ .93 = $1241.34,8+ Ans.

SECTION XLVI.

BANKING.

1. (p. 194.) $476 × .005½ = $2.61,8 Ans.
2. $1000 × .010½ = $10.50 Ans.
3. $7800 × .015½ = $120.90 Ans.
4. $8000 × .010½ = $84.00 Ans.
5. $760 × .025½ = $19.38; $760 − $19.38 = $740.62 Ans.
6. $1728 × .015½ = $26.78,4; $1728 − $26.78,4 = $1701.21,6 Ans.
7. $7860 × .030½ = $239.73; $7860 − $239.73 = $7620.27 Ans.

8. $3.50 × 450 = $ 1575, price for which the fish were bought.
$4.00 × 450 = $ 1800, price for which they were sold.
$1800 × .03½ = $ 54.90; $1800 − $54.90 = $1745.10, received at the bank.
$1745.10 − $1575 = $170.10, gain on the fish, Ans.

SECTION XLVII.

BARTER.

1. (p. 195.) 760 × 8 = 6080 ÷ 12½ = 486⅖lb. Ans.
2. 760 × 62½ = 47500 ÷ 17 = 2794$\frac{12}{17}$lb. Ans.
3. 3 × 63 × 1.10 = 207.90 ÷ 126 = $ 1.65 Ans.
4. 12 × 112 × 8 = 10752 ÷ 196 = $ 0.54$\frac{8}{7}$ per lb. Ans.
5. 17cwt. 3qr. 4lb. = 1992lb.; 41 × 6.70 = $ 274.70 − $ 88 = $ 186.70 ÷ 1992 = $ 0.09$\frac{37}{996}$ Ans.
6. B's tea cost him 40 cents per lb., and he sells it for 50 cents per lb.; his gain, therefore, is ¼ of the principal, or 25 per cent. A's gain is 4 cents on the lb., and his gain, to be in proportion to B's, must be ¼ of the principal; A's sugar, therefore, will be 4 × 4 = 16 cents per lb., Ans.
7. 15 × 63 × 1.25 = $ 1181.25 ÷ 25 = 47¼M. staves, Ans.
8. As Q bought his oats for 35 cents per bushel, and sold them at 50 cents, his gain per cent. is 50 − 35 = 15; $\frac{15}{35} = \frac{3}{7}$ of the cost. If, therefore, we add $\frac{3}{7}$ of the cost of Z's flour to $ 5.00, we have his bartering price; thus, $\frac{3}{7}$ of $ 5.00 = $ 2.14$\frac{2}{7}$; $ 2.14$\frac{2}{7}$ + $ 5.00 = $ 7.14$\frac{2}{7}$ per barrel; and 670 × .50 = $ 335 ÷ $ 7.14$\frac{2}{7}$ = 46$\frac{8}{10}$ barrels of flour, Ans.
9. 7s. = 84d.; 6s. 8d. = 80d.; $\frac{80}{84} = \frac{20}{21}$; 100 × $\frac{20}{21}$ = 95$\frac{5}{21}$ per cent.; 7s. 6d. = 90d.; 7s. 3d. = 87d.; $\frac{87}{90} = \frac{29}{30}$; 100 × $\frac{29}{30}$ = 96⅔ per cent.; 96⅔ − 95$\frac{5}{21}$ = 1$\frac{3}{7}$ per cent. Ans. That is, Samuel Jenkins will lose 1$\frac{3}{7}$ per cent. on his corn.

SECTION XLVIII.

PRACTICE.

6. (p. 198.)

6d. = $\frac{1}{2}$) 387s. 0d. = price at 1s.
3d. = $\frac{1}{2}$) 193 6 = price at 6d.
96 9 = price at 3d.
20) 290 3
Ans. 14£. 10s. 3d. = price at 9d.

7.

2s. 6d. = $\frac{1}{8}$) 498£. 0s. 0d. = value at 1£. per lb.
Ans. 62£. 5s. 0d. = value at 2s. 6d.

8.

4s. = $\frac{1}{5}$) 384£. value at 1£. per yd.
6d. = $\frac{1}{8}$) 76 16 0 = value at 4s.
3d. = $\frac{1}{2}$) 9 12 0 = value at 6d.
4 16 0 = value at 3d.
Ans. 91£. 4s. 0d. = value at 4s. 9d.

9.

10s. = $\frac{1}{2}$) 714£. value at 1£. per yd.
5s. = $\frac{1}{2}$) 357 0 = value at 10s.
6d. = $\frac{1}{10}$) 178 10 = value at 5s.
17 17 = value at 6d.
Ans. 553£. 7s. = value at 15s. 6d.

10.

2qr. = $\frac{1}{2}$) $ 2.50 = value of 1cwt.
16
40.00 = value of 16cwt.
1qr. = $\frac{1}{2}$) 1.25 = value of 2qr.
7lb. = $\frac{1}{4}$) .62,5 = value of 1qr.
2lb. = $\frac{1}{14}$) .15,62 = value of 7lb.
1lb. = $\frac{1}{2}$) 4,49 = value of 2lb.
2,24 = value of 1lb.
Ans. $ 42.09,8+ = value of 16cwt. 3qr. 10lb.

11.

1qr. = ¼) $14 = value of 1cwt.
27
378 = value of 27cwt.
14lb. = ¼) 3.50 = value of 1qr.
7lb. = ½) 1.75 = value of 14lb.
87½ = value of 7lb.

Ans. $384.12½ = value of 27cwt. 1qr. 21lb.

12.

10cwt. = ½) $24.60 = value of 1 ton.
7
172.20 = value of 7 tons.
2cwt. = ⅕) 12.30 = value of 10cwt.
1cwt. = ½) 2.46 = value of 2cwt.
2qr. = ½) 1.23 = value of 1cwt.
7lb. = ⅛) .61.5 = value of 2qr.
7.6⅞ = value of 7lb.

Ans. $188.88.1⅞ = value of 7T. 13cwt. 2qr. 7lb.

13.

2R. = ½) $80.50 = value of 1 acre.
25
2012.50 = value of 25 acres.
20rd. = ¼) 40.25 = value of 2 roods.
10rd. = ½) 10.06.2½ = value of 20 rods.
5rd. = ½) 5.03.1¼ = value of 10 rods
2.51.5⅝ = value of 5 rods.

Ans. $2070.35.9⅜ = value of 25A. 2R. 35rd.

14.

10rd. = $\frac{1}{16}$) $32.32 = value of 1A.
51
3232
16160
$1648.32 = value of 51A.
5rd. = $\frac{1}{2}$) 2.02 = value of 10rd.
1.01 = value of 5rd.
Ans. $1651.35 = value of 51A. 0R. 15rd.

15.

2qr. = $\frac{1}{2}$) $5.60 = value of 1yd.
7
39.20 = value of 7yd.
1qr. = $\frac{1}{4}$) 2.80 = value of 2qr.
2na. = $\frac{1}{2}$) 1.40 = value of 1qr.
.70 = value of 2na.
Ans. $44.10 = value of 7yd. 3qr. 2na.

16.

10 = $\frac{1}{10}$) $6780 = principal.
$2\frac{1}{2}$ = $\frac{1}{4}$) 678 = 10 per cent.
169.50 = $2\frac{1}{2}$ per cent.
Ans. $847.50 = $12\frac{1}{2}$ per cent.

17.

5 per cent. = $\frac{1}{20}$) $ 1728.00 = principal
1 per cent. = $\frac{1}{5}$) 86.40 = interest at 5 per cent.
17.28 = interest at 1 per cent.
6 months = $\frac{1}{2}$) 103.68 = interest at 6 per cent.
5
518.40 = interest for 5 years.
1 month = $\frac{1}{6}$) 51.84 = interest for 6 months.
15 days = $\frac{1}{2}$) 8.64 = interest for 1 month.
5 days = $\frac{1}{3}$) 4.32 = interest for 15 days.
1.44 = interest for 5 days.

Ans. $ 584.64 = interest for 5y. 7mo. 20d.

18.

10cwt. = $\frac{1}{2}$) 19£. 19s. $11\frac{3}{4}$d. = value of 1 ton.
19
379 19 $7\frac{1}{4}$ = value of 19 tons.
5cwt. = $\frac{1}{2}$) 9 19 $11\frac{7}{8}$ = value of 10cwt.
4cwt. = $\frac{1}{5}$) 4 19 $11\frac{5}{16}$ = value of 5cwt.
2qr. = $\frac{1}{3}$) 3 19 $11\frac{9}{20}$ = value of 4cwt.
1qr. = $\frac{1}{2}$) 0 9 $11\frac{19}{160}$ = value of 2qr.
14lb. = $\frac{1}{2}$) 0 4 $11\frac{19}{320}$ = value of 1qr.
7lb. = $\frac{1}{2}$) 0 2 $5\frac{639}{640}$ = value of 14lb.
4lb. = $\frac{1}{7}$) 0 1 $2\frac{1279}{1280}$ = value of 7lb.
2lb. = $\frac{1}{2}$) 0 0 $8\frac{1279}{2240}$ = value of 4lb.
1lb. = $\frac{1}{4}$) 0 0 $4\frac{1279}{4480}$ = value of 2lb.
0 0 $1\frac{1279}{17920}$ = value of $\frac{1}{2}$lb.

Ans. 399£. 19s. $5\frac{1664}{17920}$d. = value of 19T. 19cwt. [3qr. $27\frac{1}{2}$lb.

19.

2fur. = $\frac{1}{4}$) $ 18675. = cost of 1 mile.
14
261450. = cost of 14 miles.
1fur. = $\frac{1}{2}$) 4668.75, = cost of 2 furlongs.
20rd. = $\frac{1}{2}$) 2334.37,5 = cost of 1 furlong.
10rd. = $\frac{1}{2}$) 1167.18,7 = cost of 20 rods.
5rd. = $\frac{1}{2}$) 583.59,3 = cost of 10 rods.
10ft. = $\frac{1}{33}$) 291.79,6 = cost of 5 rods.
35.36,9 = cost of 10 feet.

Ans. $ 270531.07,0 = cost of 14m. 3fur. 35rd. 10ft.

SECTION XLIX.

EQUATION OF PAYMENTS.

2. (p. 199.) $50 to be paid in 2 months, is the same as $100 in 1 month; $150 in 8 months, is the same as $100 in 12 months. The equated time, then, will be, as if $100 were to be paid in 1 month, $100 in 5 months, and $100 in 12 months; that is, $100 in $1 + 5 + 12 = 18$ months; consequently $300 in $\frac{1}{3}$ of 18 months $=$ 6 months, Ans.

OPERATION.

$$\begin{array}{rl} \$\ 50 \times 2 = & 100 \\ \$100 \times 5 = & 500 \\ \$150 \times 8 = & 1200 \\ \hline \$300 \quad 300\ ) & 1800\ (\ 6 \text{ months, Ans.} \\ & 1800 \\ & \hline \end{array}$$

3. $200 to be paid in 3 months, is the same as $100 in 6 months; and $300 in 5 months, is the same as $100 in 15 months; and $500 in 10 months, is the same as $100 in 50 months. If, then, $100 is to be paid in $6 + 15 + 50 = 71$ months, $1000 should be paid in $\frac{1}{10}$ of 71 months $= \frac{71}{10} =$ 7mo. 3da. Ans.

OPERATION.

$$\begin{array}{rl} \$\ 200 \times\ 3 = & 600 \\ \$\ 300 \times\ 5 = & 1500 \\ \$\ 500 \times 10 = & 5000 \\ \hline \$1000 \quad 1000\ ) & 7100\ (7\frac{1}{10} \text{ months, Ans.} \\ & 7000 \\ & \hline \\ & 100 \end{array}$$

4. $50 for 4 months, is $1 for 200 months; and $100 for 8 months, is $1 for 800 months. If, then, $1 is to be paid in 200 + 800 = 1000 months, $150 should be paid in $\frac{1}{150}$ of 1000 months = $\frac{1000}{150} = 6\frac{2}{3}$ months. It appears, then, that $150 is paid $6\frac{2}{3}$ months before it is due. The question now is, In how much *less* than 10 months should the $250 be paid? As we have before shown that $1 is to be paid in 1000 months, $250 should be paid in $\frac{1}{250}$ of 1000 months = 1000 ÷ 250 = 4 months. We find, then, that the time in which B is to pay A, is 4 months *less* than it otherwise would have been, on account of A's making present payment. We therefore subtract 4 months from 10, and find the true answer; thus, 10 — 4 = 6 months, Ans.

OPERATION.

$$\begin{array}{rr} 50 \times 4 = 200 & \\ 100 \times 8 = 800 & \\ \hline 150 \quad 150\,) & 1000\ (\ 6\frac{2}{3}\ \text{months.} \\ & 1000 \\ & \hline \end{array}$$

$150 \times 6\frac{2}{3} = 1000 \div 250 = 4$ months;
$10 - 4 = 6$ months, Ans.

5. As $\frac{1}{2}$ of $144 is paid 7 months before it is due, it is evident the remainder, $72, is payable in 14 months; but $48 of this sum is paid in 4 months, which is 10 months before it is due. There will then remain $24 unpaid; and the question will be, How long may $24 be kept to pay the interest of $72 for 10 months? $72 for 10 months, is the same as $1 for 720 months; and $1 for 720 months, is the same as $24 for $\frac{1}{24}$ of 720 months = 720 ÷ 24 = 30 months. To the 30 months we add the 4 months, and we have the whole equated time; thus, 30 + 4 = 34 months = 2y. 10mo. Ans

OPERATION.

$$\begin{array}{rl} 144 \times 7 = 1008 & \\ \hline 72 & \\ 48 \times 4 = \quad 192 & \\ \hline 120 \qquad 24\,)\,816\,(\,34\text{mo.} = 2\text{y.}\,10\text{mo. Ans.} & \\ \hline 24 \qquad\quad 72 & \\ \hline 96 & \\ 96 & \\ \hline \end{array}$$

6. $\$133\frac{1}{3}$ in 2 months, is the same as $\$1$ in $266\frac{2}{3}$ months; and $\$266\frac{2}{3}$ in 3 months, is the same as $\$1$ in 800 months; $\$400$ in 6 months, is the same as $\$1$ in 2400 months; and $\$1$ in $266\frac{2}{3} + 800 + 2400 = 3466\frac{2}{3}$ months, is the same as $\$800$ for $\frac{1}{800}$ of $3466\frac{2}{3}$ months $= 3466\frac{2}{3} \div 800 = 4\frac{1}{3}$ months. And if $\frac{1}{2}$ of $\$800$ be paid down, the remainder, $\$400$, may be kept twice $4\frac{1}{3}$ months $= 8\frac{2}{3}$ months, Ans.

OPERATION.

$$\begin{array}{rl} \$133\frac{1}{3} \times 2 = \quad 266\frac{2}{3} & \\ 266\frac{2}{3} \times 3 = \quad 800 & \\ 400 \quad \times 6 = 2400 & \\ \hline 800 \qquad 400\,)\,3466\frac{2}{3}\,(\,8\text{ months.} & \\ 400 \qquad\quad 3200 & \\ \hline 400 \qquad\quad 266\frac{2}{3} & \\ \qquad\qquad\quad 30 & \\ \hline \qquad\quad 400\,)\,8000\,(\,20\text{ days.} & \\ \qquad\qquad\quad 800 & \\ \hline \qquad\qquad\quad\ 0 & \end{array}$$

8. The various parcels of goods will become due as follows:—

May 1, a bill amounting to $600.
July 7, " " " $370.
July 15, " " " $560
Oct. 20, " " " $420.

OPERATION.

$$
\begin{array}{rrrr}
\$600 \times & 0 = & & \\
370 \times & 67 = & 24790 & \\
560 \times & 75 = & 42000 & \\
420 \times & 172 = & 72240 & \\
\hline
\$1950 & 1950) & 139030 & (71\tfrac{580}{1950} \text{ Ans.} \\
 & & 13650 & \\
\hline
 & & 2530 & \\
 & & 1950 & \\
\hline
 & & 580 &
\end{array}
$$

The medium time of payment will therefore be $71\frac{580}{1950}$ days, that is, 72 days from May 1, which will be July 11.

NOTE.—Merchants generally prefer the following method:

$$
\begin{array}{rrrr}
\$600 \times & 0 & & \\
370 \times & 2\frac{6}{30} = & 814 & \\
560 \times & 2\frac{14}{30} = & 1381\frac{1}{3} & \\
420 \times & 5\frac{12}{30} = & 2366 & \\
\hline
\$1950 & 1950) & 4561\frac{1}{3} & (2\text{mo. } 10\tfrac{34}{1950}\text{da. Ans.}
\end{array}
$$

9. The bill will become due as follows: —

June 1, 1845,	a bill for		$675.25
Nov. 4,	"	"	376.18
" 25,	"	"	821.75
June 1, 1846,	"	"	961.25
April 1,	"	"	144.50
Aug. 10,	"	"	811.30
" 12,	"	"	567.70
" 15,	"	"	369.80

$675.25 × 0		
376.18 × 156	=	$58684.08
821.75 × 177	=	145449.75
961.25 × 365	=	348856.25
144.50 × 304	=	43928.00
811.30 × 435	=	352915.20
567.70 × 437	=	248084.90
369.80 × 440	=	162712.00
$4727.73		$4727.73)1360630.48(288.8 days, Ans.

The medium time of payment will, therefore, be 288.8 = 289 days from June 1, 1845, which will be March 16, 1846.

SECTION L.

CUSTOM-HOUSE BUSINESS.

AMERICAN DUTIES.

6. (p. 205.)

1276	(Brought up.)	7978
1280	7978	
1178	957 tare.	
1378	7021 net.	
1570	2½	
1338	14042	
8020	35105	
42 draft.	$175.52,5 Ans.	
7978		
(Carried up.)		

7.

986£.	
40	
9)39440	
$4382.22	
.44	
1752888	
1752888	
$1928.17,68 Ans.	

8.

176
145
128
148
150
747
20 wants.
727
15 leakage.
712
.15
3560
712
$106.80 Ans.

9.

270 tons.
30
$8100 Ans.

10.

7890 × .01¼ = 138.07
7890 — 138 = 7752
7752 × .04 = $310.08 [Ans.

11.

450 × 10 = 4500lb.
40 draft.
4460
357 = 8 per cent.
4103
.04
$164.12 Ans.

SECTION LII.

PROPORTION.

5. (p. 212.) 17lb. : 365lb. :: $1.19 : $25.55 Ans.

CANCELLING.

$$\frac{365 \times 1.19}{17} = \$25.55 \text{ Ans.}$$

6. 16A. : 197A. :: $720 : $8865 Ans.

CANCELLING.

$$\frac{197 \times 720}{16} = \$8865 \text{ Ans.}$$

7. $8865 : $720 : : 197A. : 16A. Ans.

CANCELLING.

$$\frac{\overset{16}{\cancel{720}} \times \cancel{197}}{\cancel{8865}} = 16\text{A. Ans.}$$

8. 15hhd. : 84hhd. : : $175.95 : $985.32 Ans.

CANCELLING.

$$\frac{\overset{11.73}{\cancel{84}} \times \cancel{175.95}}{\cancel{15}} = \$985.32 \text{ Ans.}$$

9. 12mo. : 40mo. : : $6 : $20 Ans.

CANCELLING.

$$\frac{\overset{20}{\cancel{40}} \times \cancel{6}}{\cancel{12}} = \$20 \text{ Ans.}$$

10. 15 men : 10 men : : 45 days : 30 days, Ans.

CANCELLING.

$$\frac{\overset{3}{\cancel{10}} \times \cancel{45}}{\cancel{15}} = 30 \text{ days, Ans.}$$

11. $7 + 9 = 16 : 8 + 4 = 12 : : 12 : 9$ Ans.

CANCELLING.

$$\frac{\overset{3}{\cancel{12}} \times \overset{3}{\cancel{12}}}{\cancel{16}} = 9 \text{ Ans.}$$

12. 3 men : 9 men : : 17 days : 51 days, Ans.

CANCELLING.

$$\frac{\overset{3}{\cancel{9}} \times 17}{\cancel{3}} = 51 \text{ days, Ans.}$$

13. 17 days : 51 days : : 3 men : 9 ; 9 — 3 = 6 men, Ans.

CANCELLING.

$$\frac{\overset{3}{\cancel{51}} \times 3}{\underset{1}{\cancel{17}}} = 9 \text{ ; } 9 - 3 = 6 \text{ men, Ans.}$$

14. $5\frac{1}{2}$rd. : 160rd. : : 1rd. : $29\frac{1}{11}$ rods, Ans.

15. 2bbl. : 24bbl. : : $ 12 : $ 144 Ans.

CANCELLING.

$$\frac{\overset{12}{\cancel{24}} \times 12}{\underset{1}{\cancel{2}}} = \$\,144 \text{ Ans.}$$

16. 5quin. : 75quin. : : $ 16.25 : $ 243.75 Ans.

CANCELLING.

$$\frac{\overset{15}{\cancel{75}} \times 16.25}{\underset{1}{\cancel{5}}} = \$\,243.75 \text{ Ans.}$$

17. 2 cords : 17 cords : : $ 11.50 : $ 97.75 Ans.

CANCELLING.

$$\frac{17 \times \overset{575}{\cancel{11.50}}}{\underset{1}{\cancel{2}}} = \$\,97.75 \text{ Ans.}$$

18. 7cwt. : 49cwt. : : $ 56.85 : $ 397.95 Ans.

CANCELLING.

$$\frac{\overset{7}{\cancel{49}} \times 56.85}{\underset{1}{\cancel{7}}} = \$\,397.95 \text{ Ans.}$$

19. 5A. : 35A. : : $ 375.75 : $ 2630.25 Ans.

CANCELLING.

$$\frac{\overset{7}{\cancel{35}} \times 375.75}{\underset{1}{\cancel{5}}} = \$\,2630.25 \text{ Ans.}$$

20. $ 10.50 : $ 52.50 : : 7 r. : 35pr. Ans.

CANCELLING.

$$\frac{\overset{5}{\cancel{\$2.5\emptyset}} \times 7}{\underset{1}{\cancel{1\emptyset.5\emptyset}}} = 35 \text{ pairs, Ans.}$$

21. $ 4.75 : $ 25.50 : : 19lb. : 102lb. Ans.

CANCELLING.

$$\frac{\overset{102}{\cancel{25.5\emptyset}} \times \overset{1}{\cancel{1\emptyset}}}{\underset{25}{\cancel{4.75}}} = 102\text{lb. Ans.}$$

22. 6h. : 24h. : : 48m. : 192 miles, Ans.

CANCELLING.

$$\frac{\overset{4}{\cancel{24}} \times 48}{\underset{1}{\cancel{6}}} = 192 \text{ miles, Ans.}$$

23. 3 men : 8 men : : 24d. : 64d. Ans.

CANCELLING.

$$\frac{\overset{8}{} \times \cancel{24}}{\underset{1}{\cancel{3}}} = 64 \text{ days, Ans.}$$

24. 7oz. : 42oz. : : 17 spoons : 102 spoons, Ans.

CANCELLING.

$$\frac{\overset{6}{\cancel{42}} \times 17}{\underset{1}{\cancel{7}}} = 102 \text{ spoons, Ans.}$$

25. $ 100 : $ 850 : : $ 6 : $ 51 Ans.

CANCELLING.

$$\frac{\overset{17}{\cancel{85\emptyset}} \times \overset{3}{\cancel{6}}}{\underset{2}{\cancel{1\emptyset\emptyset}}} = \$\,51 \text{ Ans.}$$

26. $6 : $32 :: $100 : $533.33⅓ Ans.

CANCELLING.

$$\frac{\overset{16}{\cancel{32}} \times 100}{\underset{3}{\cancel{6}}} = \$533.33\tfrac{1}{3} \text{ Ans.}$$

27. 20gal. : 180gal. :: 167lb. : 1503lb. Ans.

CANCELLING.

$$\frac{\overset{9}{\cancel{180}} \times 167}{\underset{1}{\cancel{20}}} = 1503\text{lb. Ans.}$$

28. 2ft. : 75ft. :: 3ft. : 112½ft. Ans.

29. $4.75 : $160 :: 36 miles : 1212$\frac{12}{19}$ miles, Ans.

30. 8 days : 12 days :: 100 men : 150 men, Ans.

CANCELLING.

$$\frac{\overset{3}{\cancel{12}} \times \overset{50}{\cancel{100}}}{\underset{2}{\cancel{8}}} = 150 \text{ men, Ans.}$$

32. BY ANALYSIS.

If ½yd. cost $\frac{3}{5}$£., 1yd. will cost $\frac{6}{5}$£., and ⅛yd. will cost $\frac{1}{8} \times \frac{6}{5} = \frac{6}{40} = \frac{3}{20}$£.; and $\frac{7}{8}$ will cost 7 times $\frac{3}{20}$£. $= \frac{7}{1} \times \frac{3}{20} = \frac{21}{20} = 1$£. 1s. 0d. Ans.

STATEMENT.

½yd. : $\frac{7}{8}$yd. :: $\frac{3}{5}$£. $= \frac{3}{1} \times \frac{7}{8} \times \frac{3}{5} = \frac{63}{40} = \frac{21}{20}$£. $= 1$£. 1s. 0d. Ans.

33. BY ANALYSIS.

In 4½yd. are 9 halves; in 13½yd. are 27 halves. If, therefore, 9 halves cost $9.75, 1 half will cost ⅛ of $9.75 $= \frac{\$9.75}{9}$, and 27 halves will cost 27 times $\frac{\$9.75}{9} = \frac{27}{1} \times \frac{\$9.75}{9} = \$29.25$ Ans.

FORM OF STATEMENT.

4½yd. : 13½yd. :: $9.75 : $29.25 Ans.

OPERATION.

$$\frac{2}{9} \times \frac{27}{2} \times \frac{\$9.75}{1} = \frac{\$263.25}{18} = \$29.25 \text{ Ans.}$$

34. BY ANALYSIS.

If it be 1in. wide, the length must be 144in.; and if it be $2\frac{1}{2}$in., it will be $144 \div 2\frac{1}{2} = 57\frac{3}{5}$in. Ans.

FORM OF STATEMENT.

$2\frac{1}{2}$in. : 1in. :: 144in. : $57\frac{3}{5}$in. Ans.

35. BY ANALYSIS.

If $\frac{7}{16}$ cost 51£., $\frac{1}{16}$ will cost $\frac{51}{7}$; and $\frac{16}{16}$, or the whole ship, will cost 16 times $\frac{51}{7}$£. $= \frac{16}{1} \times \frac{51}{7} = \frac{816}{7}$£.; $\frac{1}{32}$ of $\frac{816}{7} = \frac{1}{32} \times \frac{816}{7} = \frac{816}{224} = \frac{51}{14}$; and $\frac{3}{32}$ will cost 3 times $\frac{51}{14} = \frac{3}{1} \times \frac{51}{14} = \frac{153}{14}$£. = 10£. 18s. $6\frac{6}{7}$d. Ans.

FORM OF STATEMENT.

$\frac{7}{16} : \frac{3}{32}$ :: 51£. : 10£. 18s. $6\frac{6}{7}$d. Ans.

OPERATION.

$\frac{16}{7} \times \frac{3}{32} \times \frac{51}{1} =$ 10£. 18s. $6\frac{6}{7}$d. Ans.

36. BY ANALYSIS.

If 5yd. cost \$7, 1yd. cost \$$\frac{7}{5}$; and if 7yd. sold for \$11, 1yd. sold for \$$\frac{11}{7}$; therefore $\frac{11}{7} - \frac{7}{5} =$ \$$\frac{6}{35}$ were gained on each yard. And as \$200 were gained, there must have been $200 \div \frac{6}{35} = 1166\frac{2}{3}$yd.; and $1166\frac{2}{3} \div 129\frac{17}{77} = 9$ bales, Ans.

FORM OF STATEMENT.

5yd. : 1yd. :: \$7 : \$$\frac{7}{5}$; 7yd. : 1yd. :: \$11 : \$$\frac{11}{7}$; $\frac{11}{7} - \frac{7}{5} =$ \$$\frac{6}{35}$;
\$$\frac{6}{35}$: \$200 :: 1yd. : $1166\frac{2}{3}$yd.;
$129\frac{17}{77}$yd. : $1166\frac{2}{3}$yd. :: 1 bale : 9 bales, Ans.

37. 13° 10′ 35″ : 360° :: 24h. : 27da. 7h. 43m. + Ans

38. BY ANALYSIS.

If 7lb. cost \$$\frac{3}{4}$, 1lb. will cost $\frac{1}{7} \times \frac{3}{4} =$ \$$\frac{3}{28}$; and 12lb. will cost $\frac{12}{1} \times \frac{3}{28} =$ \$$\frac{36}{28} =$ \$1.28$\frac{4}{7}$ Ans.

FORM OF STATEMENT.

7lb. : 12lb. :: \$$\frac{3}{4}$: \$1.28$\frac{4}{7}$ Ans.

39. BY ANALYSIS.

If 7lb. cost $1.75, 1lb. will cost $\frac{1.75}{7} = \$0.25$; and if 25 cents buy 1lb., $213.50 will buy as many pounds as this sum contains 25 cents; thus, $213.50 ÷ .25 = 854lb. = 7cwt. 2qr. 14lb. Ans.

FORM OF STATEMENT.

$1.75 : $213.50 :: 7lb. : 854lb. = 7cwt. 2qr. 14lb. Ans.

40. BY ANALYSIS.

If 7oz. of gold is worth 30£., 1oz. is worth $\frac{30}{7}$£.; and 7lb. 11oz. = 95oz. is worth $\frac{95}{1} \times \frac{30}{7} = \frac{2850}{7}$£. = 407£. 2s. $10\frac{2}{7}$d. Ans.

FORM OF STATEMENT.

7oz. : 7lb. 11oz. :: 30£. : 407£. 2s. $10\frac{2}{7}$d. Ans.

41. BY ANALYSIS.

$500 for 6 months, is the same as $3000 for 1 month; and if $3000 give 1 month, $600 will give $3000 ÷ $600 = 5 months, Ans.

FORM OF STATEMENT.

$600 : $500 :: 6m. : 5m. Ans.

42. BY ANALYSIS.

If $8 give 7 oz., $1 would give 56oz., and $7\frac{1}{2}$ would give $56 \div 7\frac{1}{2} = 7\frac{7}{15}$oz. Ans.

FORM OF STATEMENT.

$7.50 : $8.00 :: 7oz. : $7\frac{7}{15}$oz. Ans.

43. BY ANALYSIS.

Each suit would contain $3\frac{3}{4} \times 1\frac{7}{8} = \frac{225}{32}$ square yards; and to clothe the regiment, it would require $\frac{1000}{1} \times \frac{225}{32} = \frac{225000}{32} = 7031\frac{1}{4}$yd. To line this cloth, it would require 7031.25 ÷ 1.25 = 5625yd. Ans.

FORM OF STATEMENT.

1 man : 1000 men :: $3\frac{3}{4} \times 1\frac{7}{8} = \frac{225}{32}$yd. : 7031$\frac{1}{4}$yd.;
$1\frac{1}{32}$yd. : 1yd. :: 7031$\frac{1}{4}$yd. : 5625yd. Ans.

44. BY ANALYSIS.

If $9\frac{5}{7}$yd. cost \$11$\frac{3}{5}$, 1yd. will cost $11\frac{3}{5} \div 9\frac{5}{7} = \$1\frac{33}{170}$; $16\frac{16}{203}$E. $= 20\frac{20}{203}$yd.; and if 1yd. cost $\$1\frac{33}{170}$, $20\frac{20}{203}$yd. will cost $20\frac{20}{203} \times 1\frac{33}{170} = \$24$ Ans.

FORM OF STATEMENT.

$9\frac{5}{7}$yd. : $16\frac{16}{203}$EE. $= 20\frac{20}{203}$yd. :: \$11$\frac{3}{5}$: \$24 Ans.

45. BY ANALYSIS.

If for \$17280 there be received \$15120 only, for \$1 there will be received $17280 \div 15120 = \$0.87\frac{1}{2}$. A will, therefore, receive $\$5670 \times .87\frac{1}{2} = \$4961.25$ Ans.

FORM OF STATEMENT.

\$17280 : \$15120 :: \$1 : $\$0.87\frac{1}{2}$;
\$1 : $\$0.87\frac{1}{2}$ :: \$5670 : \$4961.25 Ans.

46. BY ANALYSIS.

49 guineas $= 49 \times 28 = 1372$s.; and, if 57yd. cost 1372s., 1yd. will cost $1372 \div 57 = 24\frac{4}{57}$s.; $\frac{1}{4}$ of which is $6\frac{1}{57}$s. = price of 1qr. An ell English will cost 5 times as much; $6\frac{1}{57} \times 5 = 30\frac{5}{57}$s. $= 1£$. 10s. $1\frac{1}{19}$d. Ans.

FORM OF STATEMENT.

57yd. : 1EE. :: 49guin. : 1£. 10s. $1\frac{1}{19}$d. Ans.

47. BY ANALYSIS.

If \$1.15 buy 1gal., \$100 will buy $100 \div 1.15 = 86$gal. 3qt. $1\frac{1}{23}$pt. Ans.

FORM OF STATEMENT.

\$1.15 : \$100 :: 1gal. : 86gal. 3qt. $1\frac{1}{23}$pt. Ans.

48. BY ANALYSIS.

If 9 packages cost $34560, 1 package will cost $34560 \div 9 = \$3840$; and if 1 parcel cost $\$3840 \div 8 = \$480$, 1 piece will cost $\$480 \div 12 = \$40$, and 1yd. will cost $\$40 \div 20 = \$2.00$ Ans.

FORM OF STATEMENT.

9pack. : 1pack. :: $34560 : $3840;
8par. : 1par. :: $3840 : $480; 12pieces : 1 piece :: $480 : $40;
20yd. : 1yd. :: $50 : $2.00 Ans.

49. BY ANALYSIS.

If 75 gallons run into the cistern, and 40 gallons run out per hour, there is left in the cistern 35 gallons; and if 35 gallons give 1 hour, 500 gallons will give $500 \div 35 =$ 14h. 17m. $8\frac{4}{7}$sec. Ans.

FORM OF STATEMENT.

75gal. — 40gal. = 35gal.;
35gal. : 500gal. :: 1h. : 14h. 17m. $8\frac{4}{7}$sec. Ans.

50. BY ANALYSIS.

If one pair may be bought for $0.56, then for $120.96 may be had $12096 \div 56 = 216$ pair $=$ 18doz. Ans.

FORM OF STATEMENT.

$0.56 : $120.96 :: 1 pair : 216 pair = 18doz. Ans.

51. BY ANALYSIS.

If the first pipe will empty the cistern in 20 minutes, in 1 minute $\frac{1}{20}$ of it will be emptied. The second pipe will empty $\frac{1}{40}$ of it in 1 minute. The third pipe will empty $\frac{1}{75}$ of it in a minute. Therefore in 1 minute $\frac{1}{20} + \frac{1}{40} + \frac{1}{75} = \frac{53}{600}$ of the cistern will be emptied. And, if $\frac{53}{600}$ of the cistern be emptied in 1 minute, the whole will be emptied in $600 - 53 =$ 11h. $19\frac{13}{53}$m. Ans.

FORM OF STATEMENT.

20m. : 1m. :: 1cist. : $\frac{1}{20}$
40m. : 1m. :: 1cist. : $\frac{1}{40}$
75m. : 1m. :: 1cist. : $\frac{1}{75}$

$\frac{53}{600}$

$\frac{88}{600}$cist. : 1cist. :: 1m. : 11m. $19\frac{13}{53}$sec. Ans.

52. BY ANALYSIS.

If A can mow the field in 5 days, in 1 day he will mow $\frac{1}{5}$ of it. B in 1 day will mow $\frac{1}{6}$ of the field. Therefore A and B will, in one day, mow $\frac{1}{5} + \frac{1}{6} = \frac{11}{30}$ of the field; and it will require $30 \div 11 = 2\frac{8}{11}$ days to mow the whole field, Ans.

FORM OF STATEMENT.

5da. : 1da. :: 1 field : $\frac{1}{5}$; 6da. : 1da. :: 1 field : $\frac{1}{6}$;
$\frac{1}{5} + \frac{1}{6} = \frac{11}{30}$ field : 1 field :: 1 da. : $2\frac{8}{11}$da. Ans.

53. BY ANALYSIS.

To raise the wall 8 feet, it required the labor of 6 men 12 days; that is, the labor of 72 men 1 day; and to raise it 1 foot, it would take $\frac{1}{8}$ of 72 men $= 72 \div 8 = 9$ men; and to raise it the remaining $32 - 8 = 24$ feet in one day, it must require 24 times 9 men; $24 \times 9 = 216$ men. But as they have 6 days to perform the labor, it will take only $\frac{1}{6}$ of their number, $216 \div 6 = 36$ men. Ans.

FORM OF STATEMENT.

8 feet : 24 feet :: 6 men : 18 men.
Then 6 days : 12 days :: 18 men : 36 men, Ans.

54. BY ANALYSIS.

A can do $\frac{1}{20}$ of the labor in 1 day, and A and C can do $\frac{1}{12}$ of it; therefore C alone can do only $\frac{1}{12} - \frac{1}{20} = \frac{1}{30}$ of

it. It will therefore take him 30 days to build the boat alone, Ans.

FORM OF STATEMENT.

$\frac{1}{12} - \frac{1}{20} = \frac{1}{30} : 1 :: 1$ day : 30 days, Ans.

55. BY ANALYSIS.

If 700 men are provided with 184000lb., there are for each man $184000 \div 700 = 262\frac{8}{7}$lb. And if each person consume 5lb. per week, he will have sufficient to last him $262\frac{8}{7} \div 5 = 52\frac{4}{7}$ weeks $= 52$ weeks 4 days, Ans.

FORM OF STATEMENT.

700 men : 1 man :: 184000lb. : $262\frac{8}{7}$lb.

Then 5lb. : $262\frac{8}{7}$lb. :: 1 week : 52 weeks 4 days, Ans.

56. BY ANALYSIS.

Each man has $3 \times \frac{3}{4} = \frac{9}{4}$lb. of beef per week, and 25 men have $25 \times \frac{9}{4} = 56\frac{1}{4}$lb. If, then, $56\frac{1}{4}$lb. last 1 week, 3150lb. will last $3150 \div 56\frac{1}{4} = 56$ weeks, Ans.

FORM OF STATEMENT.

$\frac{3}{4} \times 3 \times 25 = 56\frac{1}{4}$lb. : 3150lb. :: 1 week : 56 weeks, Ans.

57. BY ANALYSIS.

The floor contains $20 \times 16 = 320$ square feet; and $320 \times 144 = 46080$ square inches. The tiles contain $8 \times 8 = 64$ square inches each; and it will therefore require $46080 \div 64 = 720$ tiles, Ans.

FORM OF STATEMENT.

$8 \times 8 = 64$in. : $20 \times 16 \times 144 = 46080$in. :: 1 tile : 720 tiles, Ans.

58. FORM OF STATEMENT.

$10 \times 9 \times 4 = 360$ cubic inches in each stone.

$80 \times 20 \times 2\frac{1}{4} \times 1728 = 6220800$ cubic inches in the wall.

360in. : 6220800in. :: 1 stone : 17280 stones, Ans.

59. FORM OF STATEMENT.

$3.00 × 60 = $180, price given for the Holland.
$4.00 × 60 = $240, price obtained for it.
$180 : $240 :: $240 : $320 Ans.

60. BY ANALYSIS.

27 × 7 = 189 = miles A is ahead of B.

36 — 27 = 9 miles that B gains each day on A. If, therefore, 9 miles are gained in one day, it will require, to gain 189 miles, 189 ÷ 9 = 21 days, Ans.

FORM OF STATEMENT.

36 — 27 = 9m. : 189m. :: 1 day : 21 days, Ans.

61. BY ANALYSIS.

2s. 3d. = 27d., price obtained for the coffee. It is evident that 27d. is $\frac{135}{100}$ of the cost; therefore $\frac{100}{135} \times 27d. = 20d.$ was the cost, Ans.

FORM OF STATEMENT.

135d. : 100d. :: 27d. : 20d. Ans.

62. FORM OF STATEMENT.

2000 × 12 × 7 × 14 = 2352000 ÷ 16 = 147000lb. whole quantity.
105 × 200 = 21000lb. wholly spoiled.
147000 — 21000 = 126000lb. left to subsist on.
2000 × 12 × 7 = 168000 rations.
2016000 ÷ 168000 = 12oz. for each man per day, Ans.

63. FORM OF STATEMENT.

2000 × 12 × 7 × 12 = 2016000 ÷ 16 = 126000lb. quantity subsisted on.
126000 ÷ 6 = 21000lb. spoiled.
21000 × 7 = 147000lb. the whole quantity, Ans.

64. FORM OF STATEMENT.

$2000 \times 12 \times 7 \times 14 = 2352000 \div 16 = 147000$lb. whole weight.

$2000 \times 12 \times 7 \times 12 = 2016000 \div 16 = 126000$lb. left to subsist on, Ans.

65. FORM OF STATEMENT.

$2000 \times 12 \times 7 \times 12 = 2016000 \div 16 = 126000$lb.

$126000 \div 6 = 21000 =$ quantity lost.

$21000 \times 7 = 147000$lb. whole quantity.

$147000 \times 16 = 2352000 \div \overline{2000 \times 12 \times 7} = 14$oz. Ans.

66. FORM OF STATEMENT.

.85gal. : .25gal. :: \$2.72 : \$0.80 Ans.

67. FORM OF STATEMENT.

61.3lb. : 1lb. :: \$44.9942 : \$0.73.4 Ans.

68. FORM OF STATEMENT.

.15hhd. : 1hhd. :: \$2.39 : \$0.35.85 Ans.

69. FORM OF STATEMENT.

.75 ton : 1 ton :: \$15 : \$20.00 Ans.

70. FORM OF STATEMENT.

.5yd. : 6yd. :: 10yd. : 120yd. Ans.

71. FORM OF STATEMENT.

10h. : 12h. :: 15 days : 18 days, Ans.

72. FORM OF STATEMENT.

9m. : 5m. :: 450 men : 250 men; 450—250=200 men, Ans.

73. BY ANALYSIS.

As the hour hand and minute hand pass each other 11 times in 12 hours, and as they are together at 12 o'clock,

it is evident that they will next pass each other in $\frac{1}{11}$ of 12 hours = 1h. 5m. $27\frac{3}{11}$sec. Ans.

FORM OF STATEMENT.

11h. : 12h. :: 1h. : 1h. 5m. $27\frac{3}{11}$sec. Ans.

74. BY ANALYSIS.

If A and B can perform a piece of labor in $5\frac{5}{11}$ days, it is evident, that in 1 day they would do $\frac{1}{5\frac{5}{11}} = \frac{11}{60}$ of the work. If B and C can do the work in $6\frac{2}{3}$ days, in 1 day they would perform $\frac{1}{6\frac{2}{3}} = \frac{3}{20}$ of the work. If A and C can do the work in 6 days, in 1 day they would perform $\frac{1}{6}$ of it. It then appears, that A, B, and C, by laboring each 2 days, will perform $\frac{11}{60} + \frac{3}{20} + \frac{1}{6} = \frac{30}{60} = \frac{1}{2}$ of the work; and, therefore, by laboring 1 day each, they would do $\frac{1}{2}$ of $\frac{1}{2} = \frac{1}{4}$ of it. And if $\frac{1}{4}$ of the labor be performed in 1 day, it is evident that the whole work will be performed in 4 days, Ans.

If A, B, and C, can do $\frac{1}{4}$ of the work in one day, and A and B can do $\frac{11}{60}$, it is evident that C can do $\frac{1}{4} - \frac{11}{60} = \frac{4}{60} = \frac{1}{15}$ of it in 1 day, and therefore will be 15 days in performing the whole. B and C can do $\frac{3}{20}$ of it in a day; therefore A can do $\frac{1}{4} - \frac{3}{20} = \frac{1}{10}$ of it in a day, or he will be 10 days in doing the whole. A and C can do $\frac{1}{6}$ of the work in a day; therefore B can do $\frac{1}{4} - \frac{1}{6} = \frac{1}{12}$ in a day, or, in performing the whole labor, he will be 12 days, Ans.

FORM OF STATEMENT.

$5\frac{5}{11}$ days : 1 day :: 1 work : $\frac{11}{60}$ work = A and B.
$6\frac{2}{3}$ days : 1 day :: 1 work : $\frac{3}{20}$ work = B and C.
6 days : 1 day :: 1 work : $\frac{1}{6}$ work = A and C.

$\frac{1}{2}$ work = 2 A, 2 B, 2 C =
$\frac{1}{4}$ work = A, B, and C.

$\frac{1}{4} - \frac{11}{60} = \frac{1}{15}$ work : 1 work : : 1 day : 15 days = C.
$\frac{1}{4} - \frac{3}{20} = \frac{1}{10}$ work : 1 work : : 1 day : 10 days = A.
$\frac{1}{4} - \frac{1}{6} = \frac{1}{12}$ work : 1 work : : 1 day : 12 days = B.
$\frac{1}{4}$ work : 1 work : : 1 day : 4 days = A, B, and C.

75. If A, B, and C can do the work in 4 days, they would do $\frac{1}{4}$ of it in one day. If B can do it in 12 days, he would do $\frac{1}{12}$ of it in one day. If C can do the work in 15 days, he would do $\frac{1}{15}$ of it in one day. And if B can do $\frac{1}{12}$ of it, and C $\frac{1}{15}$ of it, it is evident that they both would do $\frac{1}{12} + \frac{1}{15} = \frac{3}{20}$ of it, in a day. And if B and C do $\frac{3}{20}$, and A, B, and C do $\frac{1}{4}$, in a day, it is evident that A would do $\frac{1}{4} - \frac{3}{20} = \frac{1}{10}$ of it. If A does $\frac{1}{10}$ of it and B $\frac{1}{12}$ of it in a day, they would both do $\frac{1}{10} + \frac{1}{12} = \frac{11}{60}$ of it in a day. And if $\frac{11}{60}$ of the work be done in one day, it is evident that it will take them as many days to complete the work as 11 is contained in 60. $60 \div 11 = 5\frac{5}{11}$ days, Ans.

76. As one brick contains $2 \times 4 \times 8 = 64$ cubic inches, it is evident that it will take $1728 \div 64 = 27$ bricks for every cubic foot in the walls of the house. $46 + 28 = 74$; $74 \times 2 = 148$, distance round the house. From this sum we deduct $4 \times 1\frac{1}{2} = 6$ feet, for the corners. $148 - 6 = 142$; $142 \times 25 = 3550$; $3550 \times 1\frac{1}{2} = 5325$ cubic feet in the walls. $5325 \times 27 = 143{,}775$ bricks, Ans.

77. \$ 150 : \$ 200 : : 12mo. : 16mo. Ans.

78. 7 cows : 3 cows : : 5 oxen : $2\frac{1}{7}$ oxen ; $2 + 2\frac{1}{7} = 4\frac{1}{7}$ oxen : 5 oxen : : 87 days : 105 days, Ans.

79. 8mo. : 6 — 4 = 2mo. : : 360 men : 90 men ; 360 — 90 = 270 men, Ans.

80. $10\frac{1}{4} = 10.25$; $1\frac{7}{8} = 1.875$; 100 — 5 = 95 ; 100 : 95 : : 1.875yd. : 1.78125yd. ; 100 : 95 : : 1.78125yd. : 1.6921875yd. ; 1.6921875 : 1 : : 10.25yd. : $6\frac{52}{53}$yd. Ans.

SECTION LIII.

COMPOUND PROPORTION.

4. (p. 221.)

$$\left.\begin{matrix}\$100 : \$500 \\ 12\text{mo.} : 4\text{mo.}\end{matrix}\right\} :: \$6 : \$10 \text{ Ans.}$$

CANCELLING.

$$\frac{\overset{5}{\cancel{500}} \times \overset{2}{\cancel{4}} \times 6}{\underset{1}{\cancel{100}} \times \underset{6}{\cancel{12}}} = \$10 \text{ Ans.}$$

5.

$$\left.\begin{matrix}\$6 : \$10 \\ 4\text{mo.} : 12\text{mo.}\end{matrix}\right\} :: \$100 : \$500 \text{ Ans.}$$

CANCELLING.

$$\frac{\overset{2}{\cancel{10}} \times \overset{25}{\cancel{12}} \times \cancel{100}}{\underset{1}{\cancel{6}} \times \underset{1}{\cancel{4}}} = \$500 \text{ Ans.}$$

6.

$$\left.\begin{matrix}\$500 : \$100 \\ \$6 : \$10\end{matrix}\right\} :: 12\text{mo.} : 4\text{mo. Ans.}$$

CANCELLING.

$$\frac{\overset{2}{\cancel{100}} \times \cancel{10} \times \overset{2}{\cancel{12}}}{\cancel{500} \times \underset{1}{\cancel{6}}} = 4 \text{ months, Ans.}$$

7.

$$\left.\begin{matrix}\$500 : \$100 \\ 4\text{mo.} : 12\text{mo.}\end{matrix}\right\} :: \$10 : \$6 \text{ Ans.}$$

CANCELLING.

$$\frac{\overset{2}{\cancel{100}} \times \overset{3}{\cancel{12}} \times \cancel{10}}{\cancel{500} \times \underset{1}{\cancel{4}}} = \$6 \text{ Ans.}$$

8.

8 men : 24 men
13 weeks : 52 weeks
} : : $32 : $384 Ans.

CANCELLING.

$$\frac{\overset{3}{\cancel{24}} \times \overset{4}{\cancel{52}} \times 32}{\underset{1}{\cancel{8}} \times \underset{1}{\cancel{13}}} = \$384 \text{ Ans.}$$

9.

60 men : 12 men
30 feet : 300 feet
6 feet : 8 feet
3 feet : 6 feet
8 hours : 12 hours
} : : 15 days : 120 days, Ans.

CANCELLING.

$$\frac{\overset{10}{\cancel{12}} \times \cancel{300} \times \cancel{8} \times \cancel{6} \times \cancel{12} \times \overset{1}{\cancel{15}}}{\underset{4}{\cancel{60}} \times \underset{1}{\cancel{30}} \times \underset{1}{\cancel{6}} \times \cancel{3} \times \cancel{8}} = 120 \text{ days, Ans.}$$

10.

16 horses : 32 horses
24 days : 48 days
} : : 84 bushels : 336 bushels, Ans.

CANCELLING.

$$\frac{\overset{2}{\cancel{32}} \times \overset{2}{\cancel{48}} \times 84}{\underset{1}{\cancel{16}} \times \underset{1}{\cancel{24}}} = 336 \text{ bushels, Ans.}$$

11.

644lb. : 865lb.
150 miles : 64 miles
} : : $24.58 : $14.08,6+ Ans.

CANCELLING.

$$\frac{\overset{173}{\cancel{865}} \times \overset{16}{\cancel{64}} \times 24.58}{\underset{161}{\cancel{644}} \times \underset{30}{\cancel{150}}} = \$14.08,6+ \text{ Ans.}$$

12.

$7\frac{1}{4}$oz. = 7.25; 4s. 2d. = 50d.; 5s. 6d. = 66d.; 1s. 2d. = 14d.

$$\left.\begin{matrix} 66\text{d.} & : & 50\text{d.} \\ 4\frac{3}{4}\text{d.} & : & 14\text{d.} \end{matrix}\right\} :: 7.25\text{oz.} : 16\tfrac{11}{627}\text{oz. Ans.}$$

CANCELLING.

$$\frac{\overset{2}{\cancel{50}} \times \overset{7}{\cancel{14}} \times 7.25}{\underset{33}{\cancel{66}} \times \underset{19}{\cancel{4.75}}} = 16\tfrac{11}{627}\text{oz. Ans.}$$

13.

$$\left.\begin{matrix} 24 \text{ men} & : & 496 \text{ men} \\ 9 \text{ hours} & : & 11 \text{ hours} \\ 7 \text{ hard.} & : & 4 \text{ hard.} \\ 465 \text{ feet} & : & 337\frac{1}{2} \text{ feet} \\ 3\frac{3}{5} \text{ feet} & : & 5\frac{3}{5} \text{ feet} \\ 2\frac{1}{3} \text{ feet} & : & 3\frac{1}{2} \text{ feet} \end{matrix}\right\} :: 5\tfrac{1}{2} \text{ days} : 132 \text{ days, Ans.}$$

SECTION LIV.

CHAIN RULE.

2. (p. 222.)

FORM OF STATEMENT.

12lb. Boston = 10lb. Amsterdam;
10lb. Amsterdam = 12lb. Paris;
80lb. Paris.

OPERATION.

$$12 \times 10 \times 80 = \frac{9600}{120} = 80\text{lb. Ans.}$$
$$10 \times 12 =$$

3.

FORM OF STATEMENT.

25lb. Boston = 22lb. Nuremburg;
88lb. Nuremburg = 92lb. Hamburg;
46lb. Hamburg = 49lb. Lyons;
98lb. Lyons.

12

OPERATION.

$$\begin{array}{l} 25 \times 88 \times 46 \times 98 = 9917600 \\ 22 \times 92 \times 49 = \quad 99176 \end{array} = 100\text{lb. Ans.}$$

4.

FORM OF STATEMENT.

24s. Massachusetts = 32s. New York;
48s. New York = 45s. Pennsylvania;
15s. Pennsylvania = 10s. Canada;
100s. Massachusetts.

OPERATION.

$$\begin{array}{l} 32 \times 45 \times 10 \times 100 = 1440000 \\ 24 \times 48 \times 15 = \quad 1728 \end{array} = 83\tfrac{1}{3}\text{s. Ans.}$$

5.

FORM OF STATEMENT.

17 men = 25 women;
5 women = 7 boys;
75 boys.

OPERATION.

$$\begin{array}{l} 17 \times 5 \times 75 = 6375 \\ 25 \times 7 = \quad 175 \end{array} = 36\tfrac{3}{7}\text{ men, Ans.}$$

6.

FORM OF STATEMENT.

10bbl. apples = 5 cords wood;
20 cords wood = 4 tons hay;
50 tons hay.

OPERATION.

$$\begin{array}{l} 10 \times 20 \times 50 = 10000 \\ 5 \times 4 = \quad 20 \end{array} = 500\text{bbl. Ans.}$$

7.

FORM OF STATEMENT.

100A. Bradford = 120A. Haverhill;
50A. Haverhill = 65A. Methuen;
150A. Methuen.

OPERATION.

$$\begin{array}{r} 100 \times 50 \times 150 = 750000 \\ 120 \times 65 = 7800 \end{array} = 96\tfrac{2}{13}\text{A. Ans.}$$

8.

FORM OF STATEMENT.

10lb. cheese = 7lb. butter;
11lb. butter = 2bu. corn;
11bu. corn = 8bu. rye;
4bu. rye = 1 cord wood;
10 cords wood.

OPERATION.

$$\begin{array}{r} 10 \times 11 \times 11 \times 4 \times 10 = 48400 \\ 7 \times 2 \times 8 \times 1 = 112 \end{array} = 432\tfrac{1}{7}\text{lb. Ans.}$$

SECTION LV.

PARTNERSHIP, OR COMPANY BUSINESS.

(p. 224.)

2. BY ANALYSIS.

The capital is $1100. A's stock is $250; his share of the loss will therefore be $\frac{250}{1100} = \frac{5}{22}$. B's stock is $300;

his share of the loss therefore is $\frac{300}{1100} = \frac{3}{11}$. C's stock is $550, and his share of the loss therefore is $\frac{550}{1100} = \frac{1}{2}$. The loss, being 5 per cent. of the stock, is $1100 × .05 = $55.00. A's loss will therefore be $\frac{5}{22}$ of $55 = $12.50; B's loss $\frac{3}{11}$ of $55 = $15.00· and C's loss $\frac{1}{2}$ of $55 = $27.50 Ans.

FORM OF STATEMENT.

$1100 × .05 = $55.00 = loss.

$1100 : $55.00 :: $250 : $12.50 A's loss,
$1100 : $55.00 :: $300 : $15.00 B's loss,
$1100 : $55.00 :: $550 : $27.50 C's loss,
} Ans.

3. BY ANALYSIS.

The capital is $18780. C's stock being $6780, his share of the gain will be $\frac{6780}{18780} = \frac{113}{313}$ of $1000 = $361.02.2$\frac{114}{313}$. D's stock is $12000; his share of the gain will therefore be $\frac{12000}{18780} = \frac{200}{313}$ of $1000 = $638.97.7$\frac{199}{313}$ Ans.

FORM OF STATEMENT.

$18780 : $1000 :: $6780 : $361.02.2$\frac{114}{313}$ C's gain,
$18780 : $1000 :: $12000 : $638.97.7$\frac{199}{313}$ D's gain,
} Ans.

4. BY ANALYSIS.

M's stock is $3000, and his share of the gain will be $\frac{3000}{10000} = \frac{3}{10}$ of $500 = $150. P's stock is $2000; his share of the gain will therefore be $\frac{2000}{10000} = \frac{1}{5}$ of $500 = $100. Q's stock is $5000; his share of the gain, then, will be $\frac{5000}{10000} = \frac{1}{2}$ of $500 = $250 Ans.

FORM OF STATEMENT.

$10000 : $500 :: $3000 : $150 M's gain,
$10000 : $500 :: $2000 : $100 P's gain,
$10000 : $500 :: $5000 : $250 Q's gain,
} Ans.

5. BY ANALYSIS.

The whole gain is $332.50; but C's gain is $120; A and B's gain, therefore, is $332.50 — $120 = $212.50. A's stock being $500, his share of the gain will be $\frac{500}{850} = \frac{10}{17}$ of $212.50 = $125. B's stock being $350, his share of the gain will be $\frac{350}{850} = \frac{7}{17}$ of $212.50 = $87.50. As the stock of each person in the firm bears the same proportion to his gain as the other; and as A's gain is $125, and his stock $500; therefore,

$125 A's gain : $500 A's stock :: $120 C's gain : $480 C's stock

Then $480 ÷ 320 = $1.50, value of C's cloth per yard, Ans.

FORM OF STATEMENT.

$$\left.\begin{array}{l} \$850 : \$212.50 :: \$500 : \$125 \text{ A's gain,} \\ \$850 : \$212.50 :: \$350 : \$87.50 \text{ B's gain,} \end{array}\right\} \text{Ans.}$$

$$\$125 : \$500 :: \$120 : \$480 \text{ value of C's stock.}$$

$$\$480 \div 320 = \$1.50 \text{ C's cloth per yard, Ans}$$

6. BY ANALYSIS.

$$\$5000 + \$6500 + \$7500 = \$19000 \text{ amount of stock.}$$

$$\$19000 \times .40 = \$7600 \text{ gross gain.}$$

$$\$7600 \times .90 = \$6840 \text{ net gain.}$$

$$\left.\begin{array}{l} \frac{5000}{19000} = \frac{5}{19} \text{ of } \$6840 = \$1800 \text{ A's gain,} \\ \frac{6500}{19000} = \frac{13}{38} \text{ of } \$6840 = \$2340 \text{ B's gain,} \\ \frac{7500}{19000} = \frac{15}{38} \text{ of } \$6840 = \$2700 \text{ C's gain,} \end{array}\right\} \text{Ans.}$$

FORM OF STATEMENT.

$$\left.\begin{array}{l} \$19000 : \$6840 :: \$5000 : \$1800 \text{ A's gain,} \\ \$19000 : \$6840 :: \$6500 : \$2340 \text{ B's gain,} \\ \$19000 : \$6840 :: \$7500 : \$2700 \text{ C's gain,} \end{array}\right\} \text{Ans.}$$

7. BY ANALYSIS.

Amount of debts, $600 + $760 + $840 + $800 = $3000. For every dollar, then, each creditor will receive $\frac{2718}{3000} = \$\frac{91}{120}$.

A will receive $\frac{91}{120}$ of \$600 = \$455.00,
B will receive $\frac{91}{120}$ of \$760 = \$576.33$\frac{1}{3}$,
C will receive $\frac{91}{120}$ of \$840 = \$637.00,
D will receive $\frac{91}{120}$ of \$800 = \$606.66$\frac{2}{3}$,
} Ans.

FORM OF STATEMENT.

\$3000 : \$2275 :: \$600 . \$455.00 A receives,
\$3000 : \$2275 :: \$760 : \$576.33$\frac{1}{3}$ B receives,
\$3000 : \$2275 :: \$840 : \$637.00 C receives,
\$3000 : \$2275 :: \$800 : \$606.66$\frac{2}{3}$ D receives,
} Ans.

8. BY ANALYSIS.

As the bankrupt owes \$5000, and his effects are only \$4000, he will pay on each dollar $\frac{4000}{5000} = \frac{4}{5} =$ \$0.80 Ans.

FORM OF STATEMENT.

\$5000 : \$4000 :: \$1.00 : \$0.80 Ans.

9. BY ANALYSIS.

As \$1728 is $\frac{15}{100}$ of the sum owed, that sum must be $\frac{100}{15}$ of \$1728 = \$11520 Ans.

FORM OF STATEMENT.

\$0.15 : \$100 :: \$1728 : \$11520 Ans.

SECTION LVI.

PARTNERSHIP ON TIME.

(p. 226.)

2. BY ANALYSIS.

$3200 for 12 months, is the same as $38400 for 1 month; and $4200 for 8 months, is the same as $33600 for 1 month. Therefore the whole stock may be considered $38400 + $33600 = $72000. A's share of the profit will therefore be $\frac{38400}{72000} = \frac{8}{15}$ of $240 = $128; B's share will be $\frac{33600}{72000} = \frac{7}{15}$ of $240 = $112 Ans.

FORM OF STATEMENT.

$3200 × 12 = $38400 A's product.
$4200 × 8 = $33600 B's product.

$72000

$72000 : $240 :: $38400 : $128 A's gain,
$72000 : $240 :: $33600 : $112 B's gain, } Ans.

BY ANALYSIS.

3. $300 for 5 months, is the same as $1500 for 1 month; $400 for 8 months, is the same as $3200 for 1 month; $500 for 3 months, is the same as $1500 for 1 month. The capital, then, may be considered $1500 + $3200 + $1500 = $6200. A's share of the gain will therefore be $\frac{1500}{6200} = \frac{15}{62}$ of $100 = 24.19\frac{11}{31}$; B's share, $\frac{3200}{6200} = \frac{16}{31}$ of $100 = 51.61\frac{9}{31}$; C's share, $\frac{1500}{6200} = \frac{15}{62}$ of $100 = 24.19\frac{11}{31}$ Ans.

FORM OF STATEMENT.

$300 × 5 = $1500
$400 × 8 = $3200
$500 × 3 = $1500

$6200

$6200 : $100 :: $1500 : 24.19\frac{11}{31}$ A's gain,
$6200 : $100 :: $3200 : 51.61\frac{9}{31}$ B's gain, } Ans.
$6200 : $100 :: $1500 : 24.19\frac{11}{31}$ C's gain,

4. 24 oxen for 8 weeks, is 1 ox for 192 weeks; 18 oxen for 12 weeks, is 216 oxen for 1 week; and 12 oxen for 10 weeks, is 1 ox for 120 weeks. The amount of pasturing is 192 + 216 + 120 = 528 weeks. A's share is $\frac{192}{528} = \frac{4}{11}$ of $26.40=$9.60; B's share is $\frac{216}{528} = \frac{9}{22}$ of $26.40=$10.80; C's share is $\frac{120}{528} = \frac{5}{22}$ of $26.40 = $6.00 Ans.

FORM OF STATEMENT.

24 oxen × 8 = 192 oxen;
18 oxen × 12 = 216 oxen;
12 oxen × 10 = 120 oxen;

528 oxen.

528 : $26.40 :: 192 : $9.60 what A pays,
528 : $26.40 :: 216 : $10.80 what B pays, } Ans.
528 : $26.40 :: 120 : $6.00 what C pays,

5. The "stock in trade" is a carriage to ride 144 miles; and the expense for the carriage, $25, may be considered the "loss," and the proportional part which each rode, the *time*. Now, by the Rule, each man is to bear his share of the loss (expense) in proportion as he has the use of the stock in trade (carriage). The two men had the use of the whole stock in trade for the first 20 miles, for which they pay $\frac{20}{144}$ of $25 = $3.47.2$\frac{2}{9}$; therefore, the share of each, for this distance, is $\frac{1}{2}$ of $3.47.2$\frac{2}{9}$=$1.73.6$\frac{1}{9}$. For the next 52

miles the carriage was occupied by the two gentlemen and A. The expense of the carriage for this distance was $\$9.02.7\frac{7}{9}$, it being $\frac{52}{144}$ of $\$25$, of which each paid $\frac{1}{5} = \$3.00.9\frac{7}{27}$. For the next 42 miles, there were four passengers, viz. the two gentlemen, and A and B. The expense for this distance was $\frac{42}{144}$ of $\$25 = \$7.29.1\frac{2}{3}$, and each of the four passengers paid $\$1.82.2\frac{11}{12}$. For the remaining part of the distance, 30 miles, the expense was $\frac{30}{144}$ of $\$25 = \$5.20.8\frac{1}{3}$; and as C has been received into the carriage, each person bears $\frac{1}{5}$ of the expense for this distance, $\$1.04.1\frac{2}{3}$. Thus we perceive that each of the two gentlemen pays $\$1.73.6\frac{1}{3} + \$3.00.9\frac{7}{27} + \$1.82.2\frac{11}{12} + \$1.04.1\frac{2}{3} = \$7.60.9\frac{103}{108}$; A pays $\$3.00.9\frac{7}{27} + \$1.82.2\frac{11}{12} + \$1.04.1\frac{2}{3} = \$5.87.3\frac{91}{108}$; B pays $\$1.82.2\frac{11}{12} + \$1.04.1\frac{2}{3} = \$2.86.4\frac{7}{12}$; C pays $\$1.04.1\frac{2}{3}$ Ans

FORM OF STATEMENT.

$\overline{\frac{20}{144}\times\frac{1}{2}} + \overline{\frac{52}{144}\times\frac{1}{3}} + \overline{\frac{42}{144}\times\frac{1}{4}} + \overline{\frac{30}{144}\times\frac{1}{5}} = \frac{526}{1728}$, first man's product.

$\overline{\frac{20}{144}\times\frac{1}{2}} + \overline{\frac{52}{144}\times\frac{1}{3}} + \overline{\frac{42}{144}\times\frac{1}{4}} + \overline{\frac{30}{144}\times\frac{1}{5}} = \frac{526}{1728}$, 2d man's product.

$\overline{\frac{52}{144}\times\frac{1}{3}} + \overline{\frac{42}{144}\times\frac{1}{4}} + \overline{\frac{30}{144}\times\frac{1}{5}} = \frac{406}{1728}$, A's prod.

$\overline{\frac{42}{144}\times\frac{1}{4}} + \overline{\frac{30}{144}\times\frac{1}{5}} = \frac{198}{1728}$, B's prod.

$\frac{30}{144}\times\frac{1}{5} = \frac{72}{1728}$, C's prod.

$\overline{\frac{1728}{1728}}$, sum of the products,

$\frac{1728}{1728} : \$25 :: \frac{526}{1728} : \$7.60.9\frac{103}{108}$, first man's expense,
$\frac{1728}{1728} : \$25 :: \frac{526}{1728} : \$7.60.9\frac{103}{108}$, 2d man's expense,
$\frac{1728}{1728} : \$25 :: \frac{406}{1728} : \$5.87.3\frac{91}{108}$, A's expense,
$\frac{1728}{1728} : \$25 :: \frac{198}{1728} : \$2.86.4\frac{7}{12}$, B's expense,
$\frac{1728}{1728} : \$25 :: \frac{72}{1728} : \$1.04.1\frac{2}{3}$, C's expense,
} Ans.

6. $\$4000$ for 4 months, is $\$100$ for 160 months. $\$4000 + \$500 = \$4500$ for 12 months, is $\$100$ for 540 months; and $\$4500 - \$1000 = \$3500$ for 4 months, is $\$100$ for 140 months. A may therefore be considered as

having $100 in trade 160 + 540 + 140 = 840 months. Again, $3000 for 10 months, is $100 for 300 months. $3000 — $1500 = $1500 for 4 months, is $100 for 60 months. $1500 + $3000 = $4500 for 6 months, is $100 for 270 months. B may therefore be considered as having $100 in trade for 300 + 60 + 270 = 630 months. Again, $2000 for 6 months, is $100 for 120 months. $2000 + $2000 = $4000 for 8 months, is $100 for 320 months. $4000 + $2000 = $6000 for 2 months, is $100 for 120 months. $6000 — $1500 = $4500 for 4 months, is $100 for 180 months. C may therefore be considered as having $100 in trade 120 + 320 + 120 + 180 = 740 months. The sum of A, B, and C's time is 840 + 630 + 740 = 2210 months. A's share of the gain will therefore be $\frac{840}{2210}$ of $4420 = $1680; B's share, $\frac{630}{2210}$ of $4420 = $1260; C's share $\frac{740}{2210}$ of $4420 = $1480 Ans.

FORM OF STATEMENT.

$4000 × 4 = 16000	$3000 × 10 = 30000
500	1500
4500 × 12 = 54000	1500 × 4 = 6000
1000	3000
3500 × 4 = 14000	4500 × 6 = 27000
A's product = 84000	B's product = 63000

$2000 × 6 = 12000	
2000	
4000 × 8 = 32000	A s product, 84000
2000	B's product, 63000
6000 × 2 = 12000	C's product, 74000
1500	221000
4500 × 4 = 18000	
C's product = 74000	

$221000 . $4420 :: $84000 : $1680 A's gain,
$221000 : $4420 :: $63000 : $1260 B's gain,
$221000 : $4420 :: $74000 : $1480 C's gain, } Ans.

7. $4000 for 6 months, is $100 for 240 months. $4000 — $2000 = $2000 for 18 months, is $100 for 360 months. Jones may therefore be considered as having $100 in trade for 240 + 360 = 600 months. $3500 for 8 months, is $100 for 280 months. $3500 — 1500 = $2000 for 16 months, is $100 for 320 months. Eaton, then, may be considered as having $100 in trade 280 + 320 = 600 months. $2500 for 10 months, is $100 for 250 months. $2500 + $2000 = $4500 for 14 months, is $100 for 630 months. Brown, then, may be considered as having $100 in trade 250 + 630 = 880 months. As each man is supposed to have the same capital, his share of the gain will be in proportion to the *time* his $100 has been in trade.

The sum of all their times is 600 + 600 + 880 = 2080 months.

Jones's gain will be $\frac{600}{2080}$ of $1041.80 = 300.51\frac{12}{13}$
Eaton's gain will be $\frac{600}{2080}$ of $1041.80 = 300.51\frac{12}{13}$ } Ans.
Brown's gain will be $\frac{880}{2080}$ of $1041.80 = 440.76\frac{2}{13}$

FORM OF STATEMENT.

$4000 × 6 = 24000
2000
2000 × 18 = 36000
Jones's product = 60000

$3500 × 8 = 28000
1500
2000 × 16 = 32000
Eaton's product = 60000

$2500 × 10 = 25000
2000
4500 × 14 = 63000
Brown's product = 88000

60000
60000
88000
Sum of the products = 208000

208000 : $ 1041.80 : : 60000 : $ 300.51$\frac{3}{13}$ Jones's gain,
208000 : $ 1041.80 : : 60000 : $ 300.51$\frac{3}{13}$ Eaton's gain,
208000 : $ 1041.80 : : 88000 : $ 440.76$\frac{9}{13}$ Brown's gain, } Ans.

SECTION LVIII.

PROFIT AND LOSS.

10. (p. 232.) $ 7.00 : $ 6.12,5 : : $ 100 : $ 87.50; $ 100 — $ 87.50 = $ 12.50 per cent. Ans.

11. $ 1.00 — .12,5 = .87,5; $ 7.00 × .87,5 = $ 6.12$\frac{1}{2}$ Ans.

12. $ 3.60 × 1.12$\frac{1}{2}$ = $ 4.05 Ans.

13. $ 4.05 is $\frac{100}{112\frac{1}{2}}$ of the original cost; therefore, $\frac{100}{112\frac{1}{2}}$ of 4.05 = $ 3.60 Ans.

14. $ 8.50 × 1.10 = $ 9.35 Ans.

15. $ 9.35 ÷ 1.10 = $ 8.50 Ans.

16. $ 1.00 — .15 = .85; $ 1.25 ÷ .85 = $ 1.47$\frac{1}{17}$; $ 1.47$\frac{1}{17}$ × 1.12 = $ 1.64,7$\frac{1}{17}$ Ans.

17. $ 1.00 — .15 = .85; $ 1.25 ÷ .85 = $ 1.47$\frac{1}{17}$, value of the cloth; $ 1.64,7$\frac{1}{17}$ — $ 1.47$\frac{1}{17}$ = $ 0.17,6$\frac{8}{17}$; $ 1.47$\frac{1}{17}$: $ 0.17,6$\frac{8}{17}$: : $ 100 : $ 12 per cent. Ans.

18. As 12 per cent. was gained on the cloth, $\frac{112}{100}$ of $ 1.64,7$\frac{1}{17}$ = $ 1.47$\frac{1}{17}$, cost; and $\frac{85}{100}$ × $ 1.47$\frac{1}{17}$ = $ 1.25, price for which it is sold, Ans.

19. $ 1.64,7$\frac{1}{17}$ ÷ 1.12 = $ 1.47$\frac{1}{17}$ — $ 1.25 = $ 0.22$\frac{1}{17}$; $ 1.47$\frac{1}{17}$: $ 0.22$\frac{1}{17}$: : $ 100 : $ 15 per cent. Ans.

20. $ 0.90 : $ 1.20 : : $ 100 : $ 133$\frac{1}{3}$ — $ 100 = $ 33$\frac{1}{3}$ per cent.; $ 1.12$\frac{1}{2}$: $ 1.50 : : $ 100 : $ 133$\frac{1}{3}$ — $ 100 = $ 33$\frac{1}{3}$ per cent. Both have gained $ 33$\frac{1}{3}$ per cent. Ans.

21. The present worth of 13 cents due 8 months hence is 13 ÷ 1.04 = .12$\frac{1}{2}$ cents. If, therefore, the cotton cost 12$\frac{1}{2}$ cents, and is sold for 12 cents, on each yard there is lost .125 — .12 = .005 = $\frac{5}{125}$ = .04 = 4 per cent Ans.

22. $\$2.50 \times 24 = \$60.00$, price sold at. As the cloth was sold at $7\frac{1}{2}$ per cent. loss, it is evident $\$60.00$ is $\frac{92\frac{1}{2}}{100}$ of the cost; therefore, $\frac{100}{92\frac{1}{2}}$ of $\$60.00 = \$64.86,4\frac{32}{37}$ is the cost, Ans.

23. It is evident, if $7\frac{1}{2}$ per cent. be taken from any sum, $92\frac{1}{2}$ per cent. will remain; therefore, $.92\frac{1}{2} \times \$64.86,4\frac{32}{37} = \$60$, price sold at; $\$60.00 \div 24 = \$2.50$ per yard, Ans.

24. By the last question, we perceive, that, if $7\frac{1}{2}$ per cent. be lost on $\$64.86,4\frac{32}{37}$, $\$60$ will be left; and if this be divided by $\$2.50$, we shall have the number of yards; thus, $\$60 \div \$2.50 = 24$ yards, Ans.

25. $\$64.86,4\frac{32}{37}$ was given for the cloth, and $\$2.50 \times 24 = \$60.00$ was received for it; therefore the loss was $\$64.86,4\frac{32}{37} - \$60.00 = \$4.86,4\frac{32}{37}$, or $\frac{4864\frac{32}{37}}{60000}$ of its value, $= .075 = 7\frac{1}{2}$ per cent. Ans.

26. If 17 per cent. be added to any sum, it is evident the original sum must be $\frac{100}{117}$ of the amount; therefore, $\frac{100}{117}$ of $\$12.50 = \$10.68,3\frac{80}{117}$ = the first cost, Ans.

27. If, on any sum, 25 per cent. has been lost, the original sum must have been $\frac{100}{75}$ of it. Therefore, $\frac{100}{75}$ of $\$75 = \$100$ was the price of the horse. But his real value was $\$100 \times 1.30 = \$130$; therefore he was sold for $\$130 - \$75 = \$55$ less than his value, Ans.

28. As the horse was worth 30 per cent. more than was given for him, and as he was sold for 25 per cent. less than he cost, these relative prices may be expressed thus: $\frac{130}{100}$, $\frac{75}{100}$; and their difference thus: $\frac{130}{100} - \frac{75}{100} = \frac{55}{100}$. Therefore, $\frac{55}{100} : \frac{75}{100} :: \$55 : \$75$ Ans.

29. $\$0.42 \times .95 = \$0.39,9$ Ans.

30. 63gal. — 15gal. = 48gal. remaining; $\$112 \div 48 = \$2.33\frac{1}{3} \times .95 = \$2.21,6\frac{2}{3}$ Ans.

31. $\$112 \times .95 = \$106.40$ received for the molasses; $\$106.40 \div \$2.21,6\frac{2}{3} = 48$gal. remaining; 63gal. — 48gal. = 15gal. leaked out, Ans.

32. 63gal. — 15gal. = 48gal. left; $2.21,6⅔ × 48 = $106.40; $106.40 ÷ .95 = $112 Ans.

33. 63gal. — 15gal. = 48gal.; $2.21,6⅔ × 48 = $106.40, price sold at; $112 — $106.40 = $5.60, loss; $112 : $5.60 :: $100 : $5 loss per cent. Ans.

34. $5.60 ÷ .93 = 6.02\frac{14}{93}$ value per yard; $6.25 — 6.02\frac{14}{93}$ = 0.22\frac{79}{93}$ gain on each yard; and $\frac{22\frac{79}{93}}{602\frac{14}{93}}$ = $\frac{17}{448}$ = .03$\frac{88}{93}$ = 3\frac{88}{112}$ gain per cent. Ans.

Or, 6.02\frac{14}{93}$: 0.22\frac{79}{93}$ :: $100 : 3\frac{88}{112}$ gain per cent. Ans.

35. $35 ÷ 1.04 = $33.65,3$\frac{11}{13}$ present worth of $35; $33.65,3$\frac{11}{13}$ — $30 = $3.65,3$\frac{11}{13}$ gain, Ans.

36. $1.25 ÷ .75 = $1.66⅔, value of the tea; $1.66⅔ — $1.40 = $0.26⅔ loss per pound. Therefore, $\frac{26\frac{2}{3}}{166\frac{2}{3}}$ = $\frac{8}{50}$ = .16 = $16 per cent. loss, Ans.

Or, $1.66⅔ : $0.26⅔ :: $100 : $16 per cent. loss, Ans.

37. $1.35 × .88 = $1.18,8, price for ¼ in ready money; $1.18,8 : $1.00 :: $5.00 : 4.20\frac{84}{297}$, cash price of 1 yard; $1.18,8 × 50 = $59.40, value of the indigo · $59.40 ÷ 3 = $19.80; $59.40 — $19.80 = $39.60; $39.60 ÷ $5.00 = 7$\frac{33}{25}$ yards delivered by B, Ans.

SECTION LIX.

DUODECIMALS.

2. (p. 235.) 29ft. 0′ 4″.

3. 66ft. 4′ 6″.

4. 44ft. 0′ 10″.

5. 79ft. 11′ 0″ 6‴ 6⁗.

6. 745ft. 6′ 10″ 2‴ 4⁗.

7. 1176ft. 1′ 6″.

8. 10ft. 2′ 10″.

9. 20ft. + 14ft. 6′ = 34ft. 6′ × 2 = 69ft. × 10ft. 4′ = 713ft.; 3ft. 2′ × 6ft. × 2 = 38ft.; 4ft. 4′ × 4ft. =

17ft. 4′ + 38ft. = 55ft. 4′; 713ft. — 55ft. 4′ = 657ft. 8′ ÷ 9 = $73\frac{2}{27}$ yards, Ans.

10. 53ft. 6′ × 10ft. 3′ × 2ft. = 1096ft. 9′ Ans.

11. 6ft. 8′ + 5ft. 9′ + 4ft. 6′ + 3ft. 10′ = 20ft. 9′ × 3ft. 5′ × 4 = 283ft. 7′ Ans.

12. 3ft. 4′ + 2ft. 10′ = 6ft. 2′ × 2 = 12ft. 4′ × 7ft. 9′ = 95ft. 7′; 3ft. 4′ × 2ft. 10′ × 2 = 18ft. 10′ 8″ + 95ft. 7′ = 114ft. 5′ 8″ × 15 = 1717ft. 1′ square feet; 3ft. 4′ × 2ft. 10′ × 7ft. 9′ × 15 = 1097ft. 11′ ÷ 27 = $40\frac{215}{324}$ cubic yards, Ans.

13. 20ft. + 16ft. 6′ = 36ft. 6′ × 2 = 73ft. × 9ft. 6′ = 693ft. 6′; 20ft. × 16ft. 6′ = 330ft.; 330ft. + 693ft. 6′ = 1023ft. 6′ × 3 = 3070ft. 6′ ÷ 9 = 341yd. 1ft. 6′; 341yd. 1ft. 6′ — 90yd. = 251yd. 1ft. 6′ Ans.

14. 17ft. 6′ × 1ft. 7′ = 27ft. 8′ 6″ Ans.

15. 27ft. 9′ × 2ft. 5′ = 67ft. 0′ 9″ Ans.

16. 47ft. × 17ft. 9′ = 834ft. 3′ Ans.

17. 18ft. 9′ × 1ft. 6′ × 3 = 84ft. 4′ 6″ Ans.

18. 20ft. × 1ft. 6′ × $2\frac{1}{2}$ = 75ft. Ans.

19. 40ft. 6′ × 2ft. 6′ × $2\frac{3}{4}$ = 278ft. 5′ 3″ Ans.

20. 18ft. × 6ft. × 4ft. = 432ft. ÷ 128 = $3\frac{3}{8}$ cords, Ans.

21. 10ft. × 5ft. × 7ft. = 350ft. ÷ 128 = 2 cords 94 cubic feet, Ans.

22. 35ft. × 4ft. × 4ft. = 560ft. ÷ 128 = $4\frac{3}{8}$ cords, Ans.

23. 8ft. × 8ft. × 8ft. = 512ft. ÷ 128 = 4 cords, Ans.

24. 10ft. × 10ft. × 10ft. = 1000ft. ÷ 128 = $7\frac{3}{16}$ cords, Ans.

25. 70ft. 6′ × 5ft. 3′ = 370ft. 1′ 4″ ÷ 4 = $92\frac{11}{16}$ cord feet; $92\frac{11}{16} \div 8 = 11\frac{145}{256}$ cords, Ans.

26. 97ft. 9′ × 3ft. 6′ = 342ft. 1′ 6″ ÷ 4 = $85\frac{111}{256}$ cord feet ÷ 8 = $10\frac{177}{256}$ cords, Ans.

27. 100ft. × 6ft. 11′ = 691ft. 8′ ÷ 4 = $172\frac{11}{12}$ cord feet ÷ 8 = $21\frac{23}{96}$ cords, Ans.

28. 8ft. × 4ft. × 10 = 320ft. × 2′ = $53\frac{1}{3}$ft. × 5 = $266\frac{2}{3}$ ÷ 128 = $2.08\frac{1}{3}$ Ans.

29. 3ft. 8′ × 5ft. = 18ft. 4′ ÷ 2 = 9$\frac{1}{6}$ feet, Ans.

30. 3ft. 10′ × 6ft. 6′ = 24ft. 11′ ÷ 2 = 12$\frac{11}{24}$ feet, Ans.

31. 128ft. ÷ 8 = 16ft. ÷ 3ft. 6′ = 4ft. 6′ 10$\frac{2}{7}$″ Ans.

32. 128ft. × 2 = 256ft. ÷ 12 = 21ft. 4′ ÷ 3ft. 9′ = 5ft. 8′ 3$\frac{1}{5}$″ Ans.

33. 14ft. 8in. + 17ft. 9in. = 32ft. 5in; 32ft. 5in. × 2 = 64ft. 10in., length round the room; 64ft. 10in. × 8ft. 9in. = 567ft. 3$\frac{1}{2}$in., contents of the upright parts of the room; 17ft. 9in. × 14ft. 8in. = 260ft. 4in., contents of the upper part of the room; 7ft. × 3ft. 4in. × 2 = 46ft. 8in., contents of the doors; 5ft. 3in. × 3ft. 4in. × 4 = 70ft., contents of the windows; 64ft. 10in. — 6ft. 8in. = 58ft. 2in., length of the mop-boards; 58ft. 2in. × 0ft. 9in. = 43ft. 7$\frac{1}{2}$in., contents of the mop-boards; 46ft. 8in. + 70ft. + 43ft. 7$\frac{1}{2}$in. = 160ft. 3$\frac{1}{2}$in.; 567ft. 3$\frac{1}{2}$in. + 260ft. 4in. = 827ft. 7$\frac{1}{2}$in.; 827ft. 7$\frac{1}{2}$in. — 160ft. 3$\frac{1}{2}$in. = 667ft. 4in.; 667ft. 4in. ÷ 9 = 74$\frac{4}{7}$ yards of plastering; 74$\frac{4}{7}$ × .10 = $ 7.41$\frac{3}{7}$, cost of the plastering. 567ft. 3$\frac{1}{2}$in. — 160ft. 3$\frac{1}{2}$in. = 407ft.; 3ft. × 1ft. 8in. = 5ft.; 407ft. ÷ 5 = 81$\frac{2}{5}$ yards of paper; 81$\frac{2}{5}$ × .06$\frac{1}{4}$ = $ 5.08$\frac{3}{4}$, cost of the paper. 407 ÷ 9 = 45$\frac{2}{3}$; 45$\frac{2}{3}$ × .04 = $ 1.80$\frac{8}{9}$, cost of papering. 14in. × 10in. × 4 × 12 = 6720in.; 6720in. ÷ 144 = 46$\frac{2}{3}$ft.; 46$\frac{2}{3}$ × .12$\frac{1}{2}$ = $ 5.83$\frac{1}{3}$, cost of the glass; 48 × .08 = $ 3.84, cost of setting the glass. The contents of the floor will be equal to the upper part of the room, 260ft. 4in.; 260ft. 4in. + 46ft. 8in. + 43ft. 7$\frac{1}{2}$in. = 350ft. 7$\frac{1}{2}$in., the part to be painted; 350ft. 7$\frac{1}{2}$in. × .25 = $ 9.73$\frac{23}{24}$, cost of painting. $ 7.41$\frac{13}{27}$ + $ 5.08$\frac{3}{4}$ + $ 1.80$\frac{8}{9}$ + $ 5.83$\frac{1}{3}$ + $ 3.84 + $ 9.73$\frac{23}{24}$ = $ 33.72$\frac{89}{216}$ Ans.

SECTION LX.

INVOLUTION.

2. (p. 238.)	512	4.	15625
3.	282475249	5.	$\frac{27}{64}$

6.	$\frac{1}{243}$	9.	.000004100625
7.	$50\frac{46}{81}$	10.	1
8.	$16\frac{12144}{15625}$		

SECTION LXI.

EXTRACTION OF THE SQUARE ROOT.

4. (p. 244.)	881	15.	756439
5.	999	16.	$\frac{4}{21}$
6.	3216	17.	$\frac{7}{12}$
7.	3105671	18.	$6\frac{1}{2}$
8.	15.3	19.	$7\frac{1}{4}$
9.	.027	20.	$9\frac{3}{4}$
10.	4.16	21.	$19\frac{1}{19}$
11.	19.3132079+	22.	2.5298+
12.	2.98831055+	23.	2.9519+
13.	1.4	24.	1.41421+
14.	1.77482393+		

25. $\surd 141376 = 376$ Ans.

26. $1760 \times 9 = 15840$; $\surd 15840 = 125.857+$ feet, Ans.

27. $24 \times 24 = 576 \div 2 = 288$; $\surd 288 = 16.97+$in. Ans.

28. $2 : 3 :: 2400 : 3600$; $\surd 3600 = 60$ trees in length.
$3 : 2 :: 2400 : 1600$; $\surd 1600 = 40$ trees in breadth.
$60 - 1 = 59 \times 7 = 413$; $40 - 1 = 39 \times 7 = 273$;
$413 \times 273 = 112749$ square yards, Ans.

29. $2 : 3 :: \frac{3}{4} \times \frac{3}{4} = \frac{9}{16} : \frac{27}{32} = .84375$; $\surd .84375 = .918+$in. Ans.

30. $2 \times 2 = 4 : 1.5 \times 1.5 = 2.25 :: 50$m. $: 28.125$m. $=$ 28m. $7\frac{1}{2}$sec. Ans.

31. $4 \times 4 \times 3 = 48 : 6 \times 6 \times 2 = 72 :: 4$h. $: 6$h. Ans.

32. $144 \times 144 = 20736$; $64 \times 64 = 4096$; $20736 - 4096 = 16640$; $\surd 16640 = 128.99+$ feet, Ans.

33. $20 \times 20 = 400$; $16 \times 16 = 256$; $12 \times 12 = 144$; $400 + 256 + 144 = 800$; $\surd 800 = 28.28+$ feet, Ans.

34. $128 \times 128 = 16384$; $72 \times 72 = 5184 + 16384 = 21568$; $\surd 21568 = 146.86+$ miles, Ans.

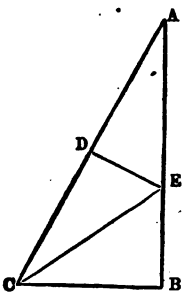
35. $100 \times 100 = 10000$; $70 - 5 = 65$; $65 \times 65 = 4225$; $10000 - 4225 = 5775$; $\surd 5775 = 75.993420+$; $80 \times 80 = 6400$; $50 - 5 = 45$; $45 \times 45 = 2025$; $6400 - 2025 = 4375$; $\surd 4375 = 66.143782+$; $75.993420 + 66.143782 = 142.137202 \times 142.137202 = 20202.984192388804$; $70 - 50 = 20$; $20 \times 20 = 400$; $20202.984192388804 + 400 = 20602.984192388804$; $\surd 20602.984192388804 = 143.537396+$ feet, Ans.

36. $400 \times 400 = 160000$; $160 \times 160 = 25600$; $160000 - 25600 = 134400$; $\surd 134400 = 366.6 - 50 = 316.6$ Ans.

37. $70 \times 70 = 4900$; $40 \times 40 = 1600$; $30 \times 30 = 900$; $4900 - 1600 = 3300$; $\surd 3300 = 57.445+$; $4900 - 900 = 4000$; $\surd 4000 = 63.245 + 57.445 = 120.69+$ feet, Ans.

38. $\frac{1}{10} \times \frac{1}{10} = \frac{1}{100} : 1^2$in. : : 450lb. : 45000lb. Ans.

39. Let A B represent the height of the tree, E the top of the stump, C the point on which the top of the tree will fall. As the tree will rest on the stump, it is evident that A E will be equal to C E. By drawing D E at right angles to A C, it is evident that A D will be equal to D C; that is, the line A C is bisected in D; therefore we have two similar triangles, A B C and A D E. This is evident from the fact, that each of these triangles has one right angle, and that the angle A is common to both triangles. Therefore as A B is to A C, so is A D to A E. If, then, we take A E from A B, the remainder E B will be the answer required.



OPERATION.

A B is 80 and B C is 40; therefore A C will be equal to the square root of the sum of the squares of A B and B C; that is $80^2 + 40^2 = 6400 + 1600 = 8000$; $\sqrt{8000} = 89.44+ =$ A C; A D will, therefore, be 44.72+. Then, as 80 : 89.44 :: 44.72+ : 49.9+, and if the fractions could all have been taken into the above operation, the fourth term would have been 50 feet. Therefore, 80 — 50 = 30 feet, Ans.

BY ALGEBRA.

Let x represent B E, $80 - x =$ C E, and 40 = C B. Then $\overline{80 - x}^2 - x^2 = 40^2$; $6400 - 16x + x^2 - x^2 = 1600$. And $160x = 6400 - 1600 = 4800$.

$x = 30$ feet = B E, Ans.

40. Circles being to each other as the squares of their diameters, they are also to each other as the squares of their semidiameters. The grindstone being 48 inches in diameter, its semidiameter will be 24 inches. $24 \times 24 = 576 \div 4 = 144$; $576 - 144 = 432$, $\sqrt{432} = 20.78 =$ to the semidiameter that will be *left* after A has ground off his share; therefore his share will be $24 - 20.78 = 3.22$in.; $432 - 144 = 288$; $\sqrt{288} = 16.97$; $20.78 - 16.97 = 3.81$in., B's share; $288 - 144 = 144$; $\sqrt{144} = 12$in.; $16.97 - 12 = 4.97$in., C's share; $\sqrt{144} = 12$in., D's share, Ans.

41. $160 \div .785398 = 203.71836$; $\sqrt{203.71836} = 14.273+$; $14.273 \div 2 = 7.136+$ rods, Ans.

42. We first find the number of square feet in an acre, $160 \times 272\frac{1}{4} = 43560$ feet. If we extract the square root of this number we obtain the side of a square field, that will contain an acre; thus, $\sqrt{43560} = 208.712+$ feet. We now divide this number by 3.5 feet, and obtain 59.632+, the number of divisions in the first row. We perceive, therefore, that there will be 60 hills, there being one more hill than divisions. Now, if we divide 208.712+ by 59, the quotient will be 3.537 feet;

that is, the hills in the first row may be 3.537 feet apart, instead of 3.5 feet. Thus, our first row will contain 60 hills, which will be 3.537 feet apart. Our next row will contain but 59 hills, the hills being planted in the quincunx order, thus: —

To find the distance between the rows, we square $3.5 = 12.25$; we then take half of $3.537 = 1.768$, which we square $= 3.125824$; we subtract this last number from 12.25 and obtain 9.124176. The square root of this number is 3.0206 feet, equal the distance between the rows. Now, if we divide $208.712+$ by 3.0206, we obtain $69+$; therefore, the number of rows will be 70. To obtain the number of hills in the field, we multiply 70 by $60 = 4200$. But as there are 70 rows, and as half of the rows contain only 59 hills, we subtract 35 from 4200. Thus, $4200 - 35 = 4165$ hills, Ans.

43. The pupil, to understand this problem, will first obtain the number of feet in the diameter of the garden; $10 \times 16.5 = 165$ feet; $165 - 5 = 160$. The trees are, therefore, to be set on a piece of ground 160 feet in diameter. Let the pupil place 1 tree in the centre of the garden, around this let him place 6 other trees, at the distance of 10 feet from each other; he will then perceive, that they stand in a hexagonal form. Let him enlarge this hexagon by placing another row of trees around it at the distance of 10 feet each; and this will require 12 additional trees. If we examine this hexagon, we shall find that each side of it contains 3 trees. Let us enlarge this hexagon, by placing another row of trees around it, and we shall find it will require 18 trees, and that each side of the hexagon contains 4 trees. We continue thus to enlarge the hexagon, until we have set 8 rows round the centre tree. Each side of the hexagon will then contain 9 trees. To compute the number of trees in the hexagon, we find the number of trees that compose the periphery of the first hexa-

gon to be 6 trees; and the number that compose the periphery of the larger hexagon to be 48. We therefore add 6 to 48, and multiply the sum by the half of $8 = 4$; thus, $6 + 48 = 54$; $54 \times 4 = 216$. To this we add the tree in the centre, $216 + 1 = 217$. If we now examine our figure, we find we can set 4 more trees at the base of each side of the hexagon, within the limits of the prescribed field. Therefore, 4 times $6 = 24$, to be added to 217, thus $217 + 24 =$ 241 trees, Ans.

44. $49\frac{5}{8}$ feet $= 49.625$ feet; $49.625 \times 144 = 7146$ square inches; $1.5 \times 1.5 \times 2 = 4.5$; $7146 - 4.5 = 7141.5$; $7141.5 \div 6 = 1190.25$; $\surd 1190.25 = 34.5$; $34.5 + 1.5 = 36$ inches, Ans.

To understand the operation of this question, we will take six small square pieces of board, each of the same dimensions, and with these we will construct a cubic box; but, in so doing, we shall find that we need two small cubes, each of which is of the thickness of the board or plank used.

Now, if the box, after being completed, was a cube, whose sides measured 36 inches each, and if the board was $1\frac{1}{2}$ inches thick, it would require 7146 square inches of the board to make the box, as the pupil can readily perceive.

But our box was made of six square pieces of board and two small cubes, each measuring, in the present case, $1\frac{1}{2}$ inches square. If we deduct the contents of these two squares, $= 1.5 \times 1.5 \times 2 = 4.5$ square inches, from the superficial contents of the board, $= 7146$ inches, we have $7146 - 4.5 = 7141.5$ square inches remaining; and if we divide these inches by 6, we have the superficial contents of one of the square boards of which we make our box. Thus, $7141.5 \div 6 = 1190.25$. The square root of this number, $\surd 1190.25 = 34.5$, will be the width of each board. To this number we must add the thickness of the board, 1.5 inches, and we have the answer, $34.5 + 1.5 = 36$ inches.

45. $22\frac{1}{12}$ feet $= 22\frac{1}{12} \times 144 = 3242$ square inches; $2.5 \times 2.5 = 6.25$ inches; $3242 - 6.25 = 3235.75$; $3235.75 \div 7 = 462.25$; $\surd 462.25 = 21.5$; $21.5 + 2.5 = 24$ inches, the width of the box; $24 \div 2 = 12$ inches, the height; $24 \times 2 = 48$ inches, the length.

From each of these numbers we subtract 5 inches, the thickness of the two sides of the box; $12 - 5 = 7$; $24 - 5 = 19$; $48 - 5 = 43$. The inside dimensions of the box will, therefore, be 7, 19, and 43 inches, and its contents will therefore, be $7 \times 19 \times 43 = 5719$ cubic inches, Ans.

To understand the above operation, we will construct a box, that shall be twice as wide as its height, and twice as long as its width. With the materials used to construct this box, the pupil will find that he can construct a cubical box, whose sides will measure half the length of the former box. And, if it be constructed as the box in question 44, there will be material remaining sufficient to make one of the sides, after deducting the square of the thickness of the plank. Thus, if our box was 12 inches high, 24 inches wide, and 48 inches long, and was made of a plank $2\frac{1}{2}$ inches thick, it would require one whose superficial contents were 3242 inches. From this sum we deduct the square of the thickness of the plank, $2.5 \times 2.5 = 6.5$ inches, $3242 - 6.5 = 3235.5$ inches. This sum, as we have before shown, is sufficient, not only to construct the cubical box, but there will be sufficient remaining, wanting the square of the thickness of the plank, to make another, similar to one of the six squares of which we made the box. This will be evident, if the box be cut into two parts and one of them placed on the other. Therefore, we divide 3235.5 by 7, because there are materials sufficient for 7 squares, and the quotient is 462.25. The square root of this number is the length of one of the squares of which the box is made. $\surd 462.25 = 21.5$ inches. To this number we add the thickness of the plank, and we have the width

of the required box. $21.5 + 2.5 = 24$ inches, width of the box; $24 \div 2 = 12$ inches, height, and $24 \times 2 = 48$ inches, length, Ans.

SECTION LXII.

EXTRACTION OF THE CUBE ROOT.

2. (p. 251.)	327
3.	7583
4.	4.39
5.	379
6.	392
7.	478
8.	4.89
9.	.899
10.	1.2599+
11.	2.2239+
12.	4968
13.	$\frac{5}{7}$
14.	$\frac{11}{17}$
15.	$\frac{8}{9}$
16.	$\frac{32}{41}$
19.	53
20.	56
21.	57
22.	62
23.	64
24.	73
25.	74
26.	81
27.	29
28.	35

29. $3 \times 3 \times 3 = 27 : 6 \times 6 \times 6 = 216 : :$ 4lb. : 32lb. Ans.

30. $1 \times 1 \times 1 = 1 : 3.5 \times 3.5 \times 3.5 = 42.875 : :$ \$120 : \$5145 Ans.

31. 5ft. 10in. = 70in.; 10ft. $4\frac{3}{5}$in. = 124.6in.; 70 × 70 × 70 = 343000; 124.6 × 124.6 × 124.6 = 1934434.936; 343000 : 1934434.936 :: 180lb. : 1015.1+lb. Ans.

32. 2lb. : 2000lb. :: 4 × 4 × 4 = 64in. : 64000;
$\sqrt[3]{64000}$ = 40in. = 3ft. 4in. high;
2lb. : 2000lb. :: 3 × 3 × 3 = 27in. : 27000in.;
$\sqrt[3]{27000}$ = 30in. = 2ft. 6in. wide;
2lb. : 2000lb. :: $\frac{1}{4}$ × $\frac{1}{4}$ × $\frac{1}{4}$ = $\frac{1}{64}$: $\frac{1000}{64}$;
$\sqrt[3]{\frac{1000}{64}}$ = $\frac{10}{4}$ = $2\frac{1}{2}$in. thick, Ans.

33. 5×5×5 = 125ft. : 20 × 20 × 20 = 8000ft. :: 1cwt. : 64cwt. Ans.

34. 6 × 6 × 6 = 216ft. : 10×10×10 = 1000ft. :: 1 day : 4.629+ days, Ans.

35. 6 × 6 × 6 = 216ft. : 8 × 8 × 8 = 512ft. :: 600lb. : 1422.2+lb. Ans.

36. 5 × 5 × 5 = 125; 125 ÷ 4 = 31.25; 125 — 31.25 = 93.75; $\sqrt[3]{93.75}$ = 4.542+; 5 — 4.542 = .45+ inches, the first woman's share. 93.75 — 31.25 = 62.50; $\sqrt[3]{62.50}$ = 3.968; 4.542 — 3.968 = .57+ inches, share of the second woman. 62.50 — 31.25 = 31.25; $\sqrt[3]{31.25}$ = 3.149; 3.968 — 3.149 = .82+ inches, third woman's share. 3.149+ inches, fourth woman's share.

37. If Wells have 100 per cent. Rowe will have 108 per cent., and Northend 110 per cent. But Pierce has 10 per cent. more than Rowe, therefore he will have 108 × 1.10 = 118.8 per cent. 118.8 + 108 + 100 + 110 = 436.8; 5 tons = 100cwt.

Then 436.8 : 118.8 :: 100cwt. : $27\frac{54}{273}$cwt. for Pierce.
And 436.8 : 108 :: 100cwt. : $24\frac{198}{273}$cwt. for Rowe.
And 436.8 : 100 :: 100cwt. : $22\frac{244}{273}$cwt. for Wells.
And 436.8 : 110 :: 100cwt. : $25\frac{50}{273}$cwt. for Northend.

To find the feet in height that each must take, we adopt the following rule, and say, As the relative value of all their shares is to the relative value of each share, so is the cube of the height of the pyramid or stack to the cube of the height

of each man's part of the stack. But we are to compute from the top of the stack each time, and then subtract as in the following process: —

$16 \times 16 \times 16 = 4096$ feet, cube of the height of the stack.

436.8 : 118.8 :: 4096 : 1114.02197 ; $\sqrt[3]{1114.02197} = 10.366+$ feet in height for Pierce.

436.8 : 118.8 + 108 = 226.8 :: 4096 : 2126.76923076 ; $\sqrt[3]{2126.76923076} = 12.859+$ from the top of the stack. From this number we subtract the height of Pierce's stack, $12.859 - 10.366 = 2.493$ feet, for the height of Rowe's stack.

436.8 : 118.8 + 108 + 100 = 326.8 :: 4096 : 3064.49816849 ; $\sqrt[3]{3064.49816849} = 14.525$ feet from the top of the stack. From this we subtract the height of the other two stacks; $14.525 - 12.859 = 1.666$ feet for the height of Wells's stack.

If, from the height of the stack, 16 feet, we subtract the last root, we have the remaining height of the stack for Northend; thus, $16 - 14.525+ = 1.474$ feet, height of Northend's stack.

NOTE. — The decimals in the answer to the above question will vary according to the degree of accuracy required.

A GENERAL RULE FOR EXTRACTING THE ROOTS OF ALL POWERS.

3. (p. 256.)

$\dot{2}8\dot{1}9\dot{5}0\dot{6}2\dot{1}\dot{8}\dot{7}\dot{5}$(195 Ans.

		1	= 1st subtrahend.
$1^4 \times 5 =$		5)271	= 1st dividend.
19^5	=	2476099	= 2d subtrahend.
$19^4 \times 5 =$	651605)	3434072	= 2d dividend.
195^5	=	281950621875	= 3d subtrahend.

4.

$1\dot{1}7\dot{8}4\dot{2}0\dot{1}6\dot{6}0\dot{1}5\dot{6}\dot{2}\dot{5}$(325 Ans.

3^6	=	729	
$3^5 \times 6 =$		1458)4494	
32^6	=	1073741824	
$32^5 \times 6 =$	201326592)	1046783420	
325^6	=	1178420166015625	

5.

$$\dot{1}2\dot{8}3918\dot{4}6454886\dot{4}(144 \text{ Ans}$$

		1
$1^6 \times 7 =$		7)118
$14^7 =$		105413504
$14^6 \times 7 =$	52706752)	229783424
$144^7 =$		1283918464548864

6.

$$218340\dot{1}05584\dot{8}9\dot{6}(62 \text{ Ans.}$$

$6^8 =$		1679616
$6^7 \times 8 =$	2239488)	5037850
$62^8 =$		218340105584896

SECTION LXIII.

ARITHMETICAL PROGRESSION.

2. (p. 258.) $\frac{45-5}{11-1} = 4$ miles, Ans.

3. $\frac{48-3}{10-1} = 5$ years, Ans.

4. $\frac{39-3}{19-1} = 2$ years, Ans.

6. $\frac{\overline{51+7} \times 12}{2} = 348$ miles, Ans.

7. $\frac{\overline{39+3} \times 19}{2} = 399$ years, Ans.

8. $320 \times 30 = 9600 =$ rods in 30 miles; but there will be one more stone in this distance than there are rods, because there will be a stone at each end of the 30 miles. The man must travel 2 rods to bring the first stone to the basket, and

60 miles and 2 rods to bring the last stone; wherefore the following formula: —

$\frac{\sqrt{19202+2} \times 9601}{2} = 92188802$rd. $= 288090$ miles 2 rods, [Ans.

10. $\frac{39-3}{2}+1 = 19$ scholars, Ans.

11. $\frac{51-7}{4}+1 = 12$ days, Ans.

12. $\frac{\sqrt{45+3} \times \sqrt{45-3+2}}{2 \times 2} = 528$ sum of the series, Ans.

13. $\frac{\sqrt{618+6} \times \sqrt{618-6}+12}{2 \times 12} = \$\,162.24$ Ans.

14. $\frac{528 \times 2}{3+45} = 22$; $\frac{45-3}{22-1} = 2$ common difference, Ans.

15. $\frac{528 \times 2}{22} - 3 = \$\,45$; $\frac{45-3}{22-1} = \$\,2$ difference, Ans.

Section LXIV.

GEOMETRICAL SERIES,

OR SERIES BY QUOTIENT.

3. (p. 264.) $\frac{72}{3^{6-1}} = \frac{8}{27}$ first term, Ans.

4. $2 \times 2^{20-1} = \$\,10737418.24$ Ans.

5. $5 \times 3^{7-1} = 3645$ seventh term, Ans.

6. $50 \times 1.06^{5-1} = 63.123848$ last term, Ans.

7. $\$\,160 \times 1.06^{7-1} = \$\,226.96{,}305796096$ Ans.

8. $\$\,300 \times 1.05^{9-1} = \$\,443.23{,}6+$ Ans.

9. $\$\,100 \times 1.06^{31-1} = \$\,574.34{,}911729132501162641063323108026458463572521960693573877776$ Ans.

13. $\frac{10^{12}-1}{10-1} \times 1 = \$\,111111111111$ Ans.

14. $\frac{2^{40}-1}{2-1} \times 10 = \$\,1099511162777.50$ Ans.

15. $\frac{1.06^{4}-1}{1.06-1} \times 50 = 218.7308$ sum of the series, Ans.

16. By examining this question, we find there have been 21 deposits. The amount of the last deposit is $\$ 10.60$, the $\$ 10$ being on interest only one year. The last but one is $\$ 11.23,6$. The last but two is $\$ 11.91,016$. The last but three is $\$ 12.62,47696$, and so on. Thus we have a regular geometrical series, the ratio of which is 1.06, the first term $\$ 10.60$, the number of terms 21, to find the sum of all the series.

$$\frac{1.06^{21}-1}{1.06-1} \times 10.60 = \$\,423.92,2+ \text{ Ans.}$$

17. $\frac{1-(\frac{1}{4})^{5}}{1-\frac{1}{4}} \times 7 = 9\frac{83}{256}$ Ans.

18.

1	2	3	4	5	6	7	8	9	10
2	4	8	16	32	64	128	256	512	1024

12)1836

153 terms; therefore the ratio 2 is to be raised to the 152d power.

1024 = 10th power.
1024 = 10th do.
4096
2048
1024
1048576 = 20th do.
1024 = 10th do.
4194304
2097152
1048576
1073741824 = 30th do.
1073741824 = 30th do.
4294967296
2147483648
8589934592
1073741824
4294967296
7516192768
3221225472
7516192768
1073741824
1152921504606846976 = 60th do.
(Carried up.)

(Brought up.)
1152921504606846976 = 60th power.
1152921504606846976 = 60th do.

691752902764108185 6
807045053224792883 2
1037629354146162278 4
691752902764108185 6
461168601842738790 4
922337203685477580 8
691752902764108185 6
691752902764108185 6
461168601842738790 4
576460752303423488 0
115292150460684697 6
230584300921369395 2
1037629354146162278 4 = 1048576 = 20th p.
230584300921369395 2 = 4 = 2d p.
576460752303423488 0 = 4194304 = 22d p.
115292150460684697 6
115292150460684697 6

1329227995784915872903807060280344576 = 120th power.
4194304 = 22d do.

5316911983139663491615228241121378304
3987683987354747618711421180841033728
5316911983139663491615228241121378304
1196305196206424285613426354252310118 4
1329227995784915872903807060280344576
5316911983139663491615228241121378304

5575186299632655785383929568162090376495104 = 142d do.
1024 = 10th do.

2230074519853062314153571827264836150598041 6
1115037259926531157076785913632418075299020 8
5575186299632655785383929568162090376495104

5708990770823839524233143877797980545530986496 = 152d do.
.001

5708990770823839524233143877797980545530986.496 = last term.
2 = ratio.

$11417981541647679048466287755595961091061972.992 — 1 m.

Dividing by the ratio less 1 does not alter it; so that the above is the true answer.

20. $\frac{100 \times \overline{100+1} \times \overline{200+1}}{6} = 338350$ Ans.

21. $\frac{50 \times \overline{50+1} \times \overline{100+1}}{6} = 42925$ Ans.

22. $\frac{80 \times \overline{80+1} \times \overline{160+1}}{6} = 173880$ Ans.

24. $\overline{\overline{10+1} \times 5}^{2} = 3025$ Ans.

25. $\overline{\overline{50+1} \times 25}^{2} = 1625625$ Ans.

Section LXV.

INFINITE SERIES.

2. (p. 268.) $\frac{5 \times 5}{4} = 6\frac{1}{4}$ Ans.

3. $\frac{8 \times 7}{7-1} = 9\frac{1}{3}$ Ans.

4. $\frac{1 \times 3}{3-1} = 1\frac{1}{2}$ Ans.

5. $\frac{11 \times 7}{7-1} = 12\frac{5}{6}$ Ans.

6. $\frac{\frac{2}{3} \times 2}{2-1} = 1\frac{1}{3}$ Ans.

Section LXVI.

DISCOUNT BY COMPOUND INTEREST.

2. (p. 268.) $1.06^4 = 1.26247696)\$\,500.00(\$\,396.04,6+$ Ans.

3. $1.05^{10} = 1.628894)\$1000.00,0(\$\,613.91,3+$ Ans.

4. $1.06^2 = 1.1236)\$\,800.00,0(\$\,711.99,7+$

$\$\,800.00,0 - \$\,711.99,7+ = \$\,88.00,3$ Ans.

5. $\$\,1291.26$ | 6. $\$\,1428.52$ | 7. $\$\,6349.21$

Section LXVII.

ANNUITIES AT COMPOUND INTEREST.

2. (p. 269.) $\frac{1.06^5 - 1}{1.06 - 1} \times \$\,500 = \$\,2818.54,6+$ Ans.

3. $\frac{1.06^{10}-1}{1.06-1} \times \$\,1000 = \$\,13180.79{,}4+$ Ans.

4. $\frac{1.06^{3}-1}{1.06-1} \times \$\,30 = \$\,95.50{,}8+$ Ans.

7. $\frac{1.06^{10}-1}{1.06-1} \times \$\,500 = \$\,6590.39{,}75$ amount of an annuity of $\$\,500$ for 10 years; therefore

$1.06^{10} = 1.7908476\,)\,\$\,6590.39{,}75\,(\,\$\,3680.04+$ Ans.

8. By Table II. the present worth of an annuity of $\$\,1$ for 10 years is $\$\,7.360087$; then the present worth of $\$\,1000$ is $\$\,7.360087 \times 1000 = \$\,7360.08$ Ans.

9. By Table II. the present worth of an annuity of $\$\,1$ for 3 years is $\$\,2.673012$; the present worth of $\$\,1728$ is $\$\,2.673012 \times 1728 = \$\,4618.96$ Ans.

10. $\frac{1.05^{7}-1}{1.05-1} \times \$\,200 = \$\,1628.40{,}169+$ amount of an annuity of $\$\,200$ for 7 years at 5 per cent. To find the present worth of this sum, we divide it by the amount of $\$\,1$ for the given rate and time. Thus the amount of $\$\,1$ is $1.05^{7} = \$\,1.4071+$; therefore

$\$\,1.4071\,)\,\$\,1628.40{,}169\,(\,\$\,1157.27+$ Ans.

Or, $\$\,1.4071 : \$\,1.00 :: \$\,1628.40{,}169 : \$\,1157.27+$ Ans.

11. $\frac{1.06^{8}-1}{1.06-1} \times 300 = \$\,2969.23{,}9+$ amount of $\$\,300$ for 8 years. $1.06^{8} = \$\,1.593848+$ amount of $\$\,1$ for 8 years. $\$\,1.593848 : \$\,1.00 :: \$\,2969.23{,}9 : \$\,1862.93{,}8$ Ans.

12. $\frac{1.06^{9}-1}{1.06-1} \times \$\,100 = \$\,1149.13{,}16+$ amount of $\$100$ for 9 years. $1.06^{9} = \$\,1.689478959$ amount of $\$\,1$ for 9 years. $\$\,1.689478959 : \$\,1.00 :: \$1149.13{,}16+ : \$\,680.16{,}9+$ Ans.

15. By Table I. the amount of $\$\,1$ for 25 years is $\$\,47.727099$; therefore $\$800$ will amount to $\$\,800 \times \$\,47.727099 = \$\,38181.67{,}9+$ Ans.

16. By Table I. the amount of $\$\,1$ for 30 years is

$79.058186; therefore the amount of $40 is $40 × $79.058186 = $3162.32,7+ Ans.

17. By Table II. the present worth of an annuity of $1 for 40 years is $15.046297; therefore the present worth of $500 is $500 × $15.046297 = $7523.14,8+ Ans.

18. By Table I. the amount of $1 for 6 years is $6.975319; the amount, therefore, of $700 is $700 × $6.975319 = $4882.72,3+ Ans.

SECTION LXIX.

ALLIGATION.

2. (p. 276.)

19bu. at	$1.00	=	$19.00
40bu. at	.66	=	26.40
11bu. at	.50	=	5.50
70bu.	:		$50.90 :: 1bu. : $0.72,7+ Ans.

3.

3lb. at 22 carats	=	66 carats.	
3lb. at 20 carats	=	60 carats.	
6lb.	:	126 carats	:: 1lb. : 21 carats, Ans.

4.

20lb. at	$0.70	=	$14.00
15lb. at	.60	=	9.00
80lb. at	.40	=	32.00
115lb.	:		$55.00 :: 1lb. : 0.47\frac{12}{23}$ Ans.

6.

Mean rate $0.80		lb.	lb.	
	$0.50	20	20 at $0.50	
	.75	20	20 at .75	Ans.
	1.00	30 + 5	35 at 1.00	

7.

Mean rate 20 carats	carats.		
	15	4oz. of 15 carats,	
	19	3oz. of 19 carats,	Ans.
	23	1oz. of 23 carats,	
	24	5oz. of 24 carats,	

8.

$

0.00 ┐ 45gal. of water at $ 0.00
.60 ┘ 5gal. of wine at .60
.80 ┐ 15gal. of wine at .80
1.20 ┘ 75gal. of wine at 1.20

Mean rate $ 0.75 } Ans.

10.

12s. ┐ 4lb.
10s. ┘ 2lb.
6s. ┐ 2lb.
4s. ┘ 4lb.

Mean rate 8s.

4lb. : 2lb. :: 20lb. : 10lb. at 6s.
4lb. : 2lb. :: 20lb. : 10lb. at 10s. } Ans.
4lb. : 4lb. :: 20lb. : 20lb. at 12s.

11.

$ 1.75 ┐ 100 ┐ 100gal.
1.25 ┘ 100 ┘ 100gal.
.00 ┐ 75 + 25 ┘ 100gal.

Mean rate $ 1.00

100gal. : 100gal. :: 20gal. : 20gal. port wine,
100gal. : 100gal. :: 20gal. : 20gal. temperance wine, } Ans.

12.

carats.

15 ┐ 2 ┐ 2oz.
17 ┘ 2 ┘ 2oz.
18 ┐ 2 ┘ 2oz.
22 ┘ 5 + 3 + 2 ┘ 10oz.
16oz.

Mean rate 20 carats,

oz. oz. oz. oz.
2 : 2 :: 5 : 5 of 15 carats,
2 : 2 :: 5 : 5 of 17 carats, } Ans.
2 : 10 :: 5 : 25 of 22 carats,

14.

$

0.08 ┐ 5 ┐ 5lb.
.10 ┘ 5 ┘ 5lb.
.12 ┐ 5 ┘ 5lb.
.20 ┘ 7 + 5 + 3 ┘ 15lb.
30lb.

Mean rate $ 0.15

lb. lb. lb. lb.
30 : 200 :: 5 : $33\frac{1}{3}$ at 8cts.
30 : 200 :: 5 : $33\frac{1}{3}$ at 10cts.
30 : 200 :: 5 : $33\frac{1}{3}$ at 12cts. } Ans
30 : 200 :: 15 : 100 at 20cts.

SECTION LXX.

PERMUTATIONS AND COMBINATIONS.

2. (p. 280.) $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10 =$ 3628800 days, Ans.
3. $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10 \times 11 \times 12 =$ 479001600 changes. 365d. 5h. 49m. = 525949 minutes; $479001600 \div 10 = 47900160$ minutes; $47900160 \div 525949 =$ 91y. 3880lm. = 91y. 26d. 22h. 41m. Ans.
4. $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10 \times 11 \times 12 \times 13 \times 14 \times 15 \times 16 \times 17 \times 18 \times 19 \times 20 \times 21 \times 22 \times 23 \times 24 \times 25 \times 26 =$ 403291461126605635584000000 changes, Ans.
6. $26 \times 25 \times 24 \times 23 \times 22 \times 21 =$ 165765600 words, Ans.
10. $6 \times 8 \times 9 \times 9 =$ 3888 choices, Ans.
11. $6 \times 6 \times 6 \times 6 \times 6 =$ 7776 changes, Ans.

SECTION LXXI.

LIFE INSURANCE.

3. (p. 285.) $\$78.00 \times .0497 = \$3876.60$ Ans.
4. $\$2000 \times .0088 = \$17.60$ Ans.
5. $\$12,000 \times .0373 = \$447.60$; $\$447.60 \times 3 = \$1342.80$; $\$12,000 - \$1342.80 = \$10,657.20$ Ans.
6. As Swan died when he was 60 years old, his life was insured 40 years. The amount of an annuity of $\$1$ for 40 years is $\$154.761966$. (See National Arithmetic, page 271.) The insurance for $\$10,000$ for one year is $\$10,000 \times .0177 = \$177$; and the amount of the annuity of $\$177$ for 40 years is $\$154.761966 \times 177 = \$27,392.86$. From this we subtract the sum which the Company pays to the heirs of Swan, $\$27,392.86 - \$10,000 = \$17,392.86$ Ans.

SECTION LXXII.

SINGLE POSITION.

2. (p. 286.) BY ANALYSIS. — If $\frac{1}{3}$ and $\frac{1}{4}$ of any number be taken, $\frac{5}{12}$ will remain; and if 60 be $\frac{5}{12}$ of a number, 12 will be $\frac{1}{12}$; and if 12 be $\frac{1}{12}$, 12 twelfths will be 144, Ans.

3. BY ANALYSIS. — If any number be increased $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$ of itself, the number will be $2\frac{1}{12}$, or $\frac{25}{12}$ of itself; and if $\frac{25}{12}$ of a number be 125, $\frac{1}{12}$ will be 5, and $\frac{12}{12}$ will be 60, Ans.

4. BY ANALYSIS. — B's age is $\frac{1}{2}$ of A's, and C's age is $\frac{1}{3}$ of $\frac{1}{2} = \frac{1}{6}$ of A's. These fractions, then, $\frac{1}{1}$, $\frac{1}{2}$, and $\frac{1}{6}$, will express the relative proportion of their ages. The sum of these numbers is $\frac{1}{1} + \frac{1}{2} + \frac{1}{6} = \frac{5}{3}$. If $\frac{5}{3}$ be 140, $\frac{3}{3}$ will be 84 = A's age; B's age will therefore be $\frac{1}{2}$ of 84 = 42; C's age will be $\frac{1}{3}$ of 42 = 14 Ans.

5. BY ANALYSIS. — Any sum, at 6 per cent. simple interest, will, in 10 years, amount to $1\frac{3}{5}$ of itself; thus, \$ 100 × .06 = \$ 6; 6 × 10 = \$ 60; 60 + 100 = \$ 160; $\frac{160}{100} = 1\frac{3}{5} = \frac{8}{5}$; and if \$ 560 be $\frac{8}{5}$, \$ 70 will be $\frac{1}{5}$, and $\frac{5}{5}$ will be \$ 350 Ans.

6. BY ANALYSIS. — $\frac{7}{8}$ of any number is $\frac{27}{40}$ more than $\frac{1}{5}$ of it; thus, $\frac{7}{8} - \frac{1}{5} = \frac{27}{40}$; and if $\frac{27}{40}$ be 81, $\frac{1}{40}$ will be $\frac{81}{27}$, and $\frac{40}{40}$ will be $\frac{81}{27} \times \frac{40}{1} = \frac{3240}{27} = 120$ Ans.

7. BY ANALYSIS. — The difference between $\frac{3}{5}$ and $\frac{4}{7}$ is $\frac{1}{35}$; and if $\frac{1}{35}$ of a number be $2\frac{17}{35} = \frac{87}{35}$, the whole number, or $\frac{35}{35}$, will be $\frac{87}{35} \times \frac{35}{1} = 87$ Ans.

DOUBLE POSITION.

2. (p. 288.) First suppose each laid out \$ 500; then

4) \$ 500	\$ 500
125	225
625 = A's money.	275 = B's money.

Then, by the question, $2 \times 275 = \$550$ should be A's money, but A's money is $\$625$; therefore $\$625 - \$550 = \$75$ is the first error.

Again, we suppose each laid out $\$800$; then

4) $\$800$	$\$800$
200	225
$1000 =$ A's money.	$575 =$ B's money.

Then, by the question, $2 \times \$575 = \$1150$ should be A's money, but A's money is $\$1000$; therefore $\$1150 - \$1000 = \$150+$ second error.

OPERATION.

$$\begin{array}{rcl} 500 & \times & 75 - \text{ first error.} \\ 800 & & 150+ \text{ second error.} \\ 75 & & 500 \\ \hline 60000 & & 75000 \\ & & 60000 \\ & & \hline 75 + 150 = 225) 135000 (\$600 \text{ Ans.} \\ & & 1350 \\ & & \hline & & 00 \end{array}$$

By Analysis. — A having gained a sum equal to $\frac{1}{4}$ of his stock, his present stock will be $\frac{1}{4}$ of his original stock. B having lost $\$225$, and his present stock being $\frac{1}{2}$ of A's, that is, $\frac{1}{2}$ of $\frac{1}{4} = \frac{1}{8}$ of what he had at first, it will therefore follow that $\$225$ is $\frac{3}{8} - \frac{1}{8} = \frac{2}{8}$ of B's original stock. And if $\frac{2}{8}$ be $\$225$, $\frac{1}{8}$ is $\$75$; and if $\frac{1}{8}$ be $\$75$, $\frac{8}{8}$, or the whole stock, will be $8 \times \$75 = \$600$ Ans.

3. We first suppose the age of the youngest to be 10. Then, by the question, the age of the next older will be 14, and the next 18, and the oldest will be 22. But, by the supposition, the age of the oldest was twice the age of the youngest, that is, $2 \times 10 = 20$; but the age of the oldest is 22; therefore the first error is $22 - 20 = 2$— too small.

Again, we suppose the age of the youngest to be 16. Then the age of the next older will be 20, and the age of the next

24, and the age of the oldest will be 28. But, by the supposition, the age of the oldest was twice the age of the youngest, that is, $2 \times 16 = 32$; but the age of the oldest is 28; therefore the second error is $32 - 28 = 4+$ too large.

OPERATION.

First supposition,	10	2	— first error.
Second supposition,	16	4	+ second error.
	2	10	
	32	40	
		32	

$2 + 4 = 6)\,72\,(\,12$ years, the age of the youngest.
72

If the youngest be 12, the next older will be 16, and the next older will be 20, and the oldest will be 24. And as the oldest is to be twice the age of the youngest, and as 24 is twice 12, we infer our answer is correct.

By Analysis. — It appears that his oldest son was 12 years older than the youngest, and that the oldest was also twice as old as the youngest; the oldest must therefore be 24 years old, and the youngest 12; the second son being 4 years younger than the first, and the third being 4 years older than the youngest, their ages will be 20 and 16, Ans.

4. We suppose the value of the first horse to be \$ 20. Then $20 + 50 = \$\,70$ will be twice the value of the second horse, that is, the value of the second horse will be \$ 35. Then, by the question, $35 + 50 = \$\,85$ will be three times the value of the first horse, that is, the first horse will be worth $\$\,28\frac{1}{3}$. But, by the supposition, he should be worth but \$ 20; therefore $28\frac{1}{3} - 20 = \$\,8\frac{1}{3}$— is the first error. Again, we suppose the value of the first horse to be \$ 32. Then $32 + 50 = \$\,82$ will be twice the value of the second horse, that is, the second horse will be worth \$ 41. Then, by the question, $41 + 50 = \$\,91$ will be three times the value of the first horse, that is, the first horse will be worth $\$\,30\frac{1}{3}$. But, by

the supposition, he should be worth $32; therefore $32 - 30\frac{1}{3} = \$1\frac{2}{3}+$ is the second error.

OPERATION.

First supposition, 20 × $8\frac{1}{3}-$ first error.
Second supposition, 32 × $1\frac{2}{3}+$ second error.

$8\frac{1}{3}$ | 20

$266\frac{2}{3}$ | $33\frac{1}{3}$

$33\frac{1}{3}$

$8\frac{1}{3} + 1\frac{2}{3} = 10)300(\$30$, value of the first horse.
30 $\$30 + \$50 = \$80 \div 2 = \$40$, the
0 [value of the second horse.

By Analysis. — It appears by the question, that, if the saddle be put on the first horse, the horse and saddle will be twice the value of the second horse; that is, the first horse will be equal to twice the value of the second horse minus the saddle. Again, if the saddle be put on the second horse, the second horse and the saddle will be equal to three times the value of the first horse; that is, three times the value of the first horse is equal to the value of the second horse plus the saddle. We have before shown, that the value of the first horse is equal to twice the value of the second horse minus the saddle; therefore, by adding these quantities, we find that four times the value of the first horse is equal to three times the value of the second horse. Again, as the first horse and saddle were worth twice the second horse, it will follow, that the saddle is worth twice the second horse minus the first horse; that is, the saddle is worth twice the second horse minus three fourths the second horse, because we have before shown that the first horse is three fourths the value of the second horse; therefore the saddle is worth five fourths of the second horse; but the saddle is worth $50; and if five fourths of the second horse is worth $50, one fourth is worth $10, and four fourths, that is, the whole value of the second horse, will be $40; and, as we have before shown that the first

horse is worth three fourths of the second horse, his value will therefore be $30 Ans.

5. If we suppose the time to be 3 o'clock, it will be 9 hours to midnight, and $\frac{2}{3}$ of 3 hours will be equal to $\frac{8}{33}$ of 9 hours; but $\frac{2}{3}$ of 3 hours is $\frac{2}{3} \times \frac{3}{1} = \frac{6}{3} = 2$ hours, and $\frac{8}{33}$ of 9 hours is $\frac{8}{33} \times \frac{9}{1} = \frac{72}{33} = 2\frac{2}{11}$ hours; therefore the first error will be $2\frac{2}{11} - 2 = \frac{2}{11}-$. Again, we suppose the time to be 4 o'clock. Then the time to midnight will be 8 hours; therefore, by the question, $\frac{2}{3}$ of 4 hours will be equal to $\frac{8}{33}$ of 8 hours, but $\frac{2}{3}$ of 4 hours is $\frac{2}{3} \times \frac{4}{1} = \frac{8}{3} = 2\frac{2}{3}$ hours; and $\frac{8}{33}$ of 8 hours is $\frac{8}{33} \times \frac{8}{1} = \frac{64}{33} = 1\frac{31}{33}$ hours; therefore, the second error will be $2\frac{2}{3} - 1\frac{31}{33} = \frac{8}{11}+$.

OPERATION.

First supposition 3 × $\frac{2}{11}-$ = 2 / 3
Second supposition 4 × $\frac{8}{11}+$ = 8 / 24

$2 + 8 = 10)32(3$h. 12m.
30
2
60
10)120(12
120

[Ans.

When the errors are fractions, and have a common denominator, their numerators may be used in the operation as if they were whole numbers; because their value is as their numerators.

By Analysis. — Reducing $\frac{2}{3}$ and $\frac{8}{33}$ to a common denominator, the fractions will be $\frac{22}{33}$ and $\frac{8}{33}$; therefore $\frac{22}{33}$ of the time past from noon will be equal to $\frac{8}{22}$ of the time to midnight. Divide 12 hours into two parts, in the proportion of 8 to 22, and the first part will be the time from noon; thus, $8 + 22 = 30 : 8 :: 12$h. $: 3$h. 12m. Ans.

6. We first suppose their income to be $360 each. Then, as A saves $\frac{1}{12}$ of his income, he will spend $360 ÷ 12 = $30; $360 − $30 = $330 annually. As B spends $100 per annum more than A, he will spend $330 + $100 =

$430 each year; and in 10 years he will spend 10 × $430 = $4300. As his income, by the supposition, is only $360 per annum, it would be in 10 years 10 × $360 = $3600. His debt would therefore be $4300 — 3600 = $700. But by the question it was only $600; therefore the first error will be $700 — $600 = $100— too small.

Again we suppose their income to be $300 annually. Then as A saves $\frac{1}{12}$ of his, he will spend $300 ÷ 12 = $25; $300 — $25 = $275 annually; and B, by the question, will spend $275 + $100 = $375, and in 10 years he will spend 10 × $375 = $3750. B's income by the question will be only 10 × $300 = $3000; therefore his debt will be $3750 — $3000 = $750. But, by the question, it was only $600, therefore the second error will be $750 — $600 = $150— too small.

OPERATION.

First supposition 360 × 100— first error.
Second supposition 300 150— second error.

100	360
30000	9000
	45
	54000
	30000

150 — 100 = 50)24000($480, income of each, Ans.

200
400
400
0

By Analysis. — If A saves $\frac{1}{12}$ of his income, he spends $\frac{11}{12}$ of it. If B in 10 years spends $600 more than his income, he must expend each year $60 more than his income. And as B spends $100 yearly more than A, it is evident A will save $40 per annum; and as A spends $\frac{11}{12}$, $40 must be $\frac{1}{12}$ of his income; therefore his whole income will be 12 times $40 = $480 Ans.

7. By the Rule of Position.—It appears by the tenor of the question, that 90 must be so divided into two parts, that, if the larger part be multiplied by 60, and the smaller part by 80, the difference of the products shall be 3300. We therefore suppose the larger part to be 60, and the smaller part 30, and proceed according to the rule, thus: $60 \times 60 = 3600$; $30 \times 80 = 2400$. The difference between these products is $3600 - 2400 = 1200$, which is $3300 - 1200 = 2100$ *less* than it should be. Again, we divide 90 into the two parts, 80 and 10, and multiply them by 60 and 80 as before, and find the result as follows; $80 \times 60 = 4800$; $10 \times 80 = 800$; $4800 - 800 = 4000$, which is $4000 - 3300 = 700$ *more* than it should be. We then proceed by the rule, thus: $60 \times 700 = 42000$; $80 \times 2100 = 168000$; $42000 + 168000 = 210000$ sum of the products; $2100 + 700 = 2800$ sum of the errors; $210000 \div 2800 = 75$ = larger number; and $90 - 75 = 15$ smaller number. Therefore we find he labored 75 days, and was idle 15 days, Ans.

8. Assume 300 pounds to be growing on each acre (any other number would answer as well); then $3\frac{1}{3}$ acres will contain 1000 pounds. We now suppose the weekly increase to be 9 pounds; then $3\frac{1}{3}$ acres will, in four weeks, produce 120 pounds.

$$3\tfrac{1}{3} \times 300 = 1000$$
$$9 \times 3\tfrac{1}{3} \times 4 = \underline{120}$$

Amount of $3\frac{1}{3}$ acres in 4 weeks = 1120lbs.

Having found that 12 oxen will eat 1120 pounds of grass in 4 weeks, we wish to know how many pounds 21 oxen would eat in 9 weeks, which, by the following process, we find to be 4410 pounds. Thus,

$$\left.\begin{matrix} 12 : 21 \\ 4 : 9 \end{matrix}\right\} :: 1220 : 4410\text{lbs.}$$

But we find the amount of the grass of 10 acres in 9 weeks to be 3810 pounds. Thus,

$$\begin{aligned} 300 \times 10 &= 3000 \\ 9 \times 10 \times 9 &= \underline{\ 810} \\ & \quad 3810\text{lbs.} \end{aligned}$$

But, by the supposition, 21 oxen in 9 weeks would eat 4410lbs.
The first error will therefore be —600

We next suppose the weekly increase to be 18 pounds per acre; therefore, the amount of the grass of $3\frac{1}{3}$ acres in 4 weeks will be 1240 pounds. Thus,

$$\begin{aligned} 300 \times 3\tfrac{1}{3} &= 1000 \\ 18 \times 3\tfrac{1}{3} \times 4 &= \underline{\ 240} \\ & \quad 1240\text{lbs.} \end{aligned}$$

And the amount of 10 acres in 9 weeks would be 4620lbs. Thus,

$$\begin{aligned} 10 \times 300 &= 3000 \\ 10 \times 18 \times 9 &= \underline{1620} \\ & \quad 4620\text{lbs.} \end{aligned}$$

But, by the last supposition, we find that 21 oxen in 9 weeks would eat $4882\frac{1}{2}$ pounds. Thus,

$$\left.\begin{matrix} 12 : 21 \\ 4 : 9 \end{matrix}\right\} :: 1240 : 4882\tfrac{1}{2}\text{lbs.}$$

By subtracting 4620 from $4882\frac{1}{2}$ pounds, we find the second error to be $-262\frac{1}{2}$.

$$\begin{aligned} & 4882\tfrac{1}{2} \\ & \underline{4620} \\ & -262\tfrac{1}{2} \end{aligned}$$

OPERATION.

First supposition 9 × 600— first error.
Second supposition 18 × $262\frac{1}{2}$— second error.

$$\begin{array}{lll} & 600 & 9 \\ \hline 600 & 10800 & 2362\frac{1}{2} \\ 262\frac{1}{2} & 2362\frac{1}{2} & \\ \hline 337\frac{1}{2}\ ) & 8437\frac{1}{2} & (25\text{lbs. weekly increase.} \\ & 8437\frac{1}{2} & \end{array}$$

Having assumed 300 pounds to the acre, and found the weekly increase to be 25 pounds to the acre, which is $8\frac{1}{3}$ per

cent., we now proceed to find the amount of the produce of 24 acres for 18 weeks. Thus,

$$24 \times 300 = 7200$$
$$25 \times 18 \times 24 = 10800$$

Amount of 24 acres for 18 weeks = 18000lbs.

$$3\tfrac{1}{3} \times 300 = 1000$$
$$3\tfrac{1}{3} \times 4 \times 25 = 3333\tfrac{1}{3}$$

Actual amount of $3\frac{1}{3}$ acres for 4 weeks = $1333\frac{1}{3}$lbs.

The question now is, If 12 oxen eat $1333\frac{1}{3}$ pounds of grass in 4 weeks, how many oxen will eat 18000 pounds in 18 weeks? Then,

$$\left.\begin{array}{l} 1333\tfrac{1}{3}\text{lbs.} : 18000\text{lbs.} \\ 18 \text{ weeks} : 4 \text{ weeks} \end{array}\right\} :: 12 : 36 \text{ oxen, Ans.}$$

9. As the head and tail of the fish weigh 30lb. and $\frac{1}{6}$ of the body; and as the body weighs as much as the head and tail, it is evident that 30lb. is $\frac{1}{6}$ of half the weight of the fish, and 30lb. is $\frac{1}{6}$ of 36lb.; therefore the head and tail weigh 36lb. The body also must weigh 36lb., because, by the question, it weighs as much as the head and tail both; therefore the whole weight of the fish will be $36 + 36 = 72$lb. Ans.

10. OPERATIONS.

(1.) We first suppose the time to be $60\frac{1}{2}$ seconds after 12 o'clock. The hour-hand then will have passed $\frac{60.5}{43200}$ of the distance from 12 to 12 again, and the second-hand will have passed once round and $\frac{1}{120}$ of another time. The difference between these two numbers is $\frac{1}{120} - \frac{60.5}{43200} = \frac{599}{86400}$. The minute-hand will have passed $\frac{60.5}{3600}$ of the distance from 12, and the difference between this number and $\frac{1}{120}$ is $\frac{60.5}{3600} - \frac{1}{120} = \frac{732}{86400}$. We now find the difference between this last number and $\frac{599}{86400}$; $\frac{732}{86400} - \frac{599}{86400} = \frac{133}{86400}$ — first error, too small.

We next suppose the time to be 61 seconds after 12 o'clock. The hour-hand then will have passed $\frac{61}{43200}$ of the distance from 12 to 12, and the second-hand will have passed round

and $\frac{1}{60}$ of another time. The difference of these two numbers is $\frac{1}{60} - \frac{61}{43200} = \frac{659}{43200}$. We now find the difference between the second-hand and minute-hand. The minute-hand has moved in 61 seconds $\frac{61}{3600}$ of the distance from 12 to 12, the difference between $\frac{61}{3600} - \frac{1}{60} = \frac{12}{43200}$. We next find the difference between this last number and $\frac{659}{43200}$; $\frac{659}{43200} - \frac{12}{43200} = \frac{647}{43200} = \frac{1294}{86400}$ + second error. As the denominators of our errors are the same number, we may reject them in the operation; for when fractions have a common denominator, their values are as their numerators.

First supposition 60.5 — 133— first error.
Second supposition 61 — 1294+ second error.

$60.5 \times 1294 = 78287$; $61 \times 133 = 8113$; $133 + 1294 = 1427$; $78287 + 8113 = 86400$; $86400 \div 1427 = 60\frac{780}{1427}$ seconds, Ans.

(2.) Suppose the time to be $61\frac{1}{2}$ seconds after 12 o'clock. Then the hour-hand will have moved $\frac{61.5}{43200}$ of the distance from 12 o'clock to 12 again, and the minute-hand will have moved $\frac{61.5}{3600}$ of this distance, and the second-hand will have moved once round and $\frac{1.5}{60}$ again. The difference between $\frac{61.5}{43200}$ and $\frac{61.5}{3600}$ is $\frac{676.5}{43200}$. The difference between $\frac{1.5}{60}$ and $\frac{61.5}{3600}$ is $\frac{34.20}{43200}$. We then find the difference between $\frac{676.5}{43200}$ and $\frac{34.20}{43200} = \frac{334.5}{43200}$— the first error.

We then suppose the time to be 62 seconds after 12 o'clock. The hour-hand will then have moved from 12 o'clock $\frac{62}{43200}$ of the distance to 12 again, and the minute-hand have moved $\frac{62}{3600}$ of the distance, and the second-hand will have gone once round and $\frac{2}{60}$ of the distance again. The difference between $\frac{62}{3600}$ and $\frac{62}{43200}$ is $\frac{682}{43200}$. The difference between $\frac{2}{60}$ and $\frac{62}{43200}$ is $\frac{696}{43200}$. The difference between $\frac{696}{43200}$ and $\frac{682}{43200}$ is $\frac{14}{43200}$ + second error.

First supposition 61.5 — 334.5— first error.
Second supposition 62 — 14+ second error.

$61.5 \times 14 = 861$; $62 \times 334.5 = 20739$; $334.5 + 14 = 348.5$; $861 + 20739 = 21600$; $21600 \div 348.5 = 61\frac{683}{697}$ seconds, Ans.

(3.) We will first suppose the time to be 59 seconds after 12 o'clock; the hour-hand will then have advanced $\frac{59}{43200}$ of the distance from 12 o'clock to 12 again, and the second-hand will be within $\frac{1}{60}$ of the distance to 12; therefore, the whole distance between the hour-hand and the second-hand will be $\frac{1}{60} + \frac{59}{43200} = \frac{779}{43200}$; and the distance between the hour-hand and minute-hand will be $\frac{59}{3600} - \frac{59}{43200} = \frac{649}{43200}$, and the difference between $\frac{779}{43200}$ and $\frac{649}{43200} = \frac{130}{43200}$— the first error.

Again, we will suppose the time to be 58 minutes after 12 o'clock. The distance then between the second-hand and hour-hand will be $\frac{2}{60} + \frac{58}{43200} = \frac{1498}{43200}$. The distance between the hour-hand and minute-hand will be $\frac{58}{3600} - \frac{58}{43200} = \frac{638}{43200}$, and $\frac{1498}{43200} - \frac{638}{43200} = \frac{860}{43200}$— will be the second error.

First supposition 59 × 130— first error.
Second supposition 58 × 860— second error.

$59 \times 860 = 50740$; $58 \times 130 = 7540$; $860 - 130 = 730$; $50740 - 7540 = 43200$; $43200 \div 730 = 59\frac{13}{73}$ seconds, Ans.

SECTION LXXIII.

EXCHANGE.

1. (p. 297.) 9765£. 15s. 6d. = 9765.775£.; 9765.775£. × $4.84\frac{4}{9}$ = $47,309.75+ Ans.
2. 18761£. 10s. × $1.08\frac{1}{2}$ = 20,356£. 4s. $6\frac{1}{2}$d.+ Ans.
3. $81,727.75 ÷ 1.095 = $74,545.89044; $74,545.89044 ÷ $4.44\frac{4}{9}$ = 16,772£. 16s. 6d. Ans.
4. 17,000£. × 1.06 = 18,020£.; 18,020£. × $4.44\frac{4}{9}$ = $80,088.88+ Ans.
5. 172,000 francs × $1.01\frac{1}{2}$ = 174,580 francs; 174,580 francs × $.18\frac{3}{5}$ = $32,471.88 Ans.
6. 76,000 francs ÷ 5.08 = $14,960.62+ Ans.

7. 79,000 francs × .98 = 77420 francs; 77420 francs × .18⅝ = $ 14,400.12+ Ans.
8. $ 17,280 × 5.10 = 88,128 francs, Ans.
9. As 20 stivers make 1 florin, 10 stivers make .5 of a florin. Therefore 896.5 × .38 = $ 340.67 Ans.
10. $ 340.67 ÷ .38 = 896.5 = 896 florins 10 stivers, Ans.
11. As 40 paras = 1 piaster, 20 paras = .5 piaster. Therefore 78.5 × .40 = $ 31.40 Ans.
12. $ 31.40 ÷ 40 = 78.5 = 78 piasters 20 paras, Ans.

NOTE. — The pupil will perceive, that, in the work of the following questions, the *inferior* denominations are reduced to a decimal of the *superior* denomination before the operation of the question.

13. 896.5 × .50 = $ 448.25 Ans.
14. 196 rix dollars 2 florins = 590 florins; 590 × .17 = $ 100.30 Ans.
15. $ 100.30 ÷ .17 = 590 florins; 590 ÷ 3 = 196 rix dollars 2 florins, Ans.
16. 675 rix dollars 2 marks = 2027 marks; 2027 × .30 = $ 608.10 Ans.
17. $ 608.10 ÷ .30 = 2027 marks; 2027 ÷ 3 = 675 rix dollars 2 marks, Ans.
18. 286.5 × .90 = $ 257.85 Ans.
19. $ 257.85 ÷ .90 = 286 pezze 10 soldi, Ans.
20. 176.5 × .20 = $ 35.30 Ans.
21. $ 35.30 ÷ .20 = 176 lire 10 soldi, Ans.
22. 769.5 × .80 = $ 615.60 Ans.
23. $ 615.60 ÷ .80 = 769 ducati di regno 5 carlini, Ans.
24. 876 × 2.38,3 = $ 2087.50,8. As 5 scudi are equal to 2 oncie, 3 scudi are equal to $\frac{6}{5}$ oncia; therefore $ 2.38,3 × $\frac{6}{5}$ = $ 2.85,9$\frac{3}{5}$; $ 2087.50,8 + $ 2.85,9$\frac{3}{5}$ = $ 2090.36,7$\frac{3}{5}$ Ans.
25. $ 2090.36,7$\frac{3}{5}$ ÷ 2.38,3 = 876 oncie 3 scudi, Ans.
26. 7684.8 × .75 = $ 5763.60 Ans.
27. $ 5763.60 ÷ .75 = 7684 rubles 8 grieves, Ans.
28. 7689 × $ 1.00,0$\frac{67}{100}$ = $ 7694.15$\frac{163}{1000}$ Ans.

29. 7694.15\frac{163}{1000}$ ÷ 1.00,0$\frac{67}{100}$ = 7689 scudi moneta, Ans.
30. 7600 × .75 = $5700 Ans.
31. $5700 ÷ .75 = 7600 dollars of plate, Ans.
32. 476.5 × 1.07 = $509.85,5 Ans.
33. $509.85,5 ÷ 1.07 = 476 rix dollars 24 skillings, Ans.
34. 462.5 × .20 = $92.50 Ans.
35. $92.50 ÷ .20 = 462 lire 10 soldi, Ans.
36. 876.5 × .97 = $850.20,5 Ans.
37. $850.20,5 ÷ .97 = 876 rix dollars 1 florin, Ans.
38. 432.75 × .50 = $216.37½ Ans.
39. $216.37,5 ÷ .50 = 432 rupees 12 annas, Ans.
40. 678.5 × .50 = $339.25 Ans.
41. $339.25 ÷ .50 = 678 rupees 2 quarters, Ans.
42. 375 × 1.77$\frac{7}{9}$ = $666.66,6$\frac{2}{3}$ Ans.
43. $896 ÷ 1.77$\frac{7}{9}$ = 504 star pagodas, Ans.
44. 769$\frac{4}{9}$ × .92 = 707.88\frac{8}{9}$ Ans.
45. 707.88\frac{8}{9}$ ÷ .92 = 769 rix dollars 40 creutzers, Ans.

SECTION LXXV.

GEOMETRY.

1. (p. 317.) 15 × 2 = 30 feet, Ans.
2. 128 × 48 = 6144 miles, Ans.
3. 693 × 693 = 48049; 48049 ÷ 272¼ = 1764 poles, 1764 ÷ 160 = 11A. 0R. 4p. Ans.
4. 40 × 40 = 1600 feet; 20 × 20 × 2 = 800 feet; 1600 — 800 = 800 feet, Ans.
5. √3600 = 60 yards; 3600 ÷ 2 = 1800 yards; √1800 = 42.427+ yards; 60 yards — 42.427 yards = 17.573 yards; 17.573 ÷ 2 = 8.78+ yards, Ans.
6. 8 × 12 = 96 feet, Ans.
7. 12 × 18 = 216 feet; 216 ÷ 2 = 108 feet, Ans.
8. 15.6 + 9.2 + 10.4 = 35.2 feet; 35.2 ÷ 2 = 17.6 feet;

17.6 — 15.6 = 2.00; 17.6 — 9.2 = 8.4; 17.6 — 10.4 = 7.2; 17.6 × 2 × 8.4 × 7.2 = 2128.896; ✓2128.896 = 46.139+ feet, Ans.

9. 144 × 3.141592 = 452.389248 feet, Ans.
10. 7964 × 3.141592 = 25019.638688+ miles, Ans.
11. 761 × 761 × .785398 = 454840.475158 feet, Ans.
12. 320 × 3 = 960 × 960 × .785398 = 7238.227968 rods; 7238.227968 ÷ 160 = 4523.89+ acres, Ans.
13. 50 × .886227 = 44.31135+ rods, Ans.
14. 30 × .707106 = 21.21+ inches square, Ans.
15. 80 × .707106 = 56.56848+ feet, Ans.
16. 80 × .8660254 = 69.28+ feet, Ans.
17. 50 × .8660254 = 43.3+ inches, Ans.
18. 30 × .8660254 = 25.98+ inches, Ans.
19. 25,000 × .3183098 = 7957.74+ miles, Ans.
20. 50 × .3183098 = 15.91549+ inches, Ans.
21. 360 × .282094 = 101.55+ rods, Ans.
22. 10,000 × .282094 = 2820.94+ rods, Ans.
23. 5000 × .2756646 = 1378.323 feet, Ans.
24. 80 × .2756646 = 22.05+ inches, Ans.
25. 5000 × .225079 = 1125.395+ rods, Ans.
26. 100 × .225079 = 22.5+ inches square, Ans.
27. 10 ÷ .225079 = 44.42+ inches, Ans.
28. 18 ÷ .225079 = 79.97+ inches, Ans.
29. $20 \times 16\frac{1}{2} = 330$; 330 ÷ .225079 = 1466.15+ feet, Ans.
30. $1\frac{1}{2} \times 1\frac{1}{2} \times 1\frac{1}{2} = 3\frac{3}{8}$ feet, Ans.
31. $6 \times 2\frac{1}{2} \times 1\frac{3}{4} = 26\frac{1}{4}$ feet, Ans.
32. $3\frac{1}{6} \times 2\frac{2}{3} \times 2\frac{1}{2} = 21\frac{1}{3}$ feet, Ans.
33. $2\frac{1}{2} \times 3 = 7\frac{1}{2}$; $7\frac{1}{2} \div 2 = 3\frac{3}{4}$; $3\frac{3}{4} - 2\frac{1}{2} = 1\frac{1}{4} = \frac{5}{4}$; $3\frac{3}{4} = \frac{15}{4}$; $\frac{15}{4} \times \frac{5}{4} \times \frac{5}{4} \times \frac{5}{4} = \frac{1875}{256} = 7.32421875$ feet; ✓7.32421875 = 2.7063+ feet; 2.7063 × 12 = 32.47+ feet, Ans.
34. 5 + 4 + 3 = 12; 12 ÷ 2 = 6 feet; 6 — 5 = 1; 6 — 4 = 2; 6 — 3 = 3; 6 × 1 × 2 × 3 = 36; ✓36 = 6; 6 × 10 = 60 feet, Ans.

35. $2\frac{1}{2} \times 2\frac{1}{2} \times .785398 \times 12\frac{1}{2} = 61.35921875$; $61.35921875 \div 3 = 20.45+$ feet, Ans.

36. $5 + 6 + 7 = 18$; $18 \div 2 = 9$; $9 - 5 = 4$; $9 - 6 = 3$; $9 - 7 = 2$; $9 \times 4 \times 3 \times 2 = 216$; $\surd 216 = 14.69693+$; $14.69693 \times 14\frac{1}{2} = 213.105485$; $213.105485 \div 3 = 71.035+$ feet, Ans.

37. $75 \div .785398 = 95.492987$; $95.492987 \div 2 = 47.746493+$ square rods, Ans.

38. $75 \div .785398 = 95.492987$; $\surd 95.492987 = 9.772+$ rods, Ans.

39. $25 \times 25 = 625$; $625 \div 2 = 312.5$; $625 - 312.5 = 312.5$; $25 \times 25 \times .785398 = 490.87375$; $625 - 490.87375 = 134.12625$; $490.87375 - 312.5 = 178.37375$ Ans.

40. $9 \times 20 = 180$; $180 \div 2 = 90$ feet, Ans.

41. $24 \times 12 = 288$; $12 \times 12 = 144$; $144 \div 3 = 48$; $288 + 48 = 336$; $336 \times .785398 \times 40 = 10555.74912$; $10555.74912 \div 144 = 73.303+$ feet, Ans.

42. $12 \times 12 \times 12 \times .5236 = 904.78$ inches, Ans.

43. $25000 \times .31831 = 7957.75$; $7957.75 \times 7957.75 = 63325785.0625$; $63325785.0625 \times 7957.75 = 503930766081.109375$; $503930766081.109375 \times .5236 = 263858149120.06886875$ cubic miles, Ans.

44. $24 \times 3.141592 = 75.398208$; $75.398208 \times 24 = 1809.556992$ inches, Ans.

45. $7957.75 \times 25000 = 198943750$ square miles, Ans.

47. $40 \times 40 = 1600$; $1600 \div 3 = 533.3333+$; $\surd 533.3333 = 23.09+$ inches, Ans.

48. $20 \times 20 = 400$; $400 \div 3 = 133.3333+$; $\surd 133.3333 = 11.547+$; $11.547 \times 11.547 \times 11.547 = 1539.6+$ inches, Ans.

SECTION LXXVI.

GAUGING.

1. (p. 327.) 10ft. = 120in.; 5ft. = 60in.; 4ft. = 48in.; 120 × 60 × 48 = 345600; 345600 ÷ 231 = 1496$\frac{8}{77}$gal. Ans.
2. 12ft. = 144in.; 6ft. = 72in.; 2ft. = 24in.; 144 × 72 × 24 = 248832in.; 248832 ÷ 282 = 882$\frac{18}{47}$gal. Ans.
3. 15ft. = 180in.; 5ft. = 60in.; 7ft. = 84in.; 180 × 60 × 84 = 907200in.; 907200 ÷ 2150.42 = 421.8+bu. Ans.
5. 40 — 30 = 10; 10 × .65 = 6.5; 30 + 6.5 = 36.5; 36.5 × 36.5 = 1332.25; 1332.25 × 50 = 66612.5; 66612.5 ÷ 359 = 185.55+gal. Ans.
6. 40 × 30 = 1200; 40 — 30 = 10; 10 × 10 = 100; 100 ÷ 3 = 33$\frac{1}{3}$; 1200 + 33$\frac{1}{3}$ = 1233$\frac{1}{3}$; 1233$\frac{1}{3}$ × 50 = 61666.66+; 61666.66 ÷ 294 = 209.7+gal. Ans.

SECTION LXXVII.

TONNAGE OF VESSELS.

1. (p. 328.) 65 × 20 × 10 = 13000; 13000 ÷ 95 = 136$\frac{80}{95}$ tons, Ans.
2. 70 × 24 × 12 = 20160; 20160 ÷ 95 = 212$\frac{4}{19}$ tons, Ans.
3. $\frac{3}{5}$ of 30 = 18; 70 — 18 = 52; 52 × 30 × 9 = 14040, 14040 ÷ 95 = 147$\frac{15}{95}$ tons, Ans.
4. $\frac{3}{5}$ of 22 = 13.2; 75 — 13.2 = 61.8; 61.8 × 22 × 12 = 16315.2; 16315.2 ÷ 95 = 171$\frac{75}{475}$ tons, Ans.
5. $\frac{3}{5}$ of 35 = 21; 98 — 21 = 77; 77 × 35 × 17$\frac{1}{2}$ = 47162.5; 47162.5 ÷ 95 = 496$\frac{17}{38}$ tons, Ans.
6. $\frac{3}{5}$ of 40 = 24; 180 — 24 = 156; 156 × 40 × 20 = 124800; 124800 ÷ 95 = 1313$\frac{85}{95}$ tons, Ans.

7. $\frac{3}{5}$ of 21 = 12.6; 78 — 12.6 = 65.4; 65.4 × 21 × 9 = 12360.6; 12360.6 ÷ 95 = $130\frac{53}{475}$ tons, Ans.
8. $\frac{3}{5}$ of 30 = 18; 159 — 18 = 141; 141 × 30 × 15 = 63450; 63450 ÷ 95 = $667\frac{7}{19}$ tons, Ans.
9. $\frac{3}{5}$ of 80 = 48; 479 — 48 = 431; 431 × 80 × 48 = 1655040; 1655040 ÷ 95 = $17421\frac{9}{19}$ tons, Ans.
10. $\frac{3}{5}$ of 35 = 21; 200 — 21 = 179; 179 × 35 = 6265; 6265 × $17\frac{1}{2}$ = 109687.5; 109687.5 ÷ 95 = $1154\frac{3}{38}$ tons, Ans.
11. $\frac{3}{5}$ of 40 = 24; 280 — 24 = 256; 256 × 40 × 20 = 204800; 204800 ÷ 95 = $2155\frac{15}{19}$ tons, Ans.

SECTION LXXVIII.

MENSURATION OF LUMBER.

1. (p. 330.) 24 × 8 = 192; 192 ÷ 12 = 16 feet, Ans.
2. 30 × 16 = 480; 480 ÷ 12 = 40 feet, Ans.
3. 3 × 5 × 15 × 3 = 675; 675 ÷ 12 = $56\frac{1}{4}$ feet, Ans.
4. 2 × 6 × 10 × 20 = 2400; 2400 ÷ 12 = 200 feet, Ans.
5. 40 ÷ 4 = 10; 10 × 10 = 100; 100 × 30 = 3000; 3000 ÷ 144 = $20\frac{5}{6}$ feet, Ans.
6. 56 ÷ 4 = 14; 14 × 14 = 196; 196 × 50 = 9800; 9800 ÷ 144 = $68\frac{1}{18}$ feet, Ans.
7. 120 ÷ 4 = 30; 30 × 30 = 900; 900 × 90 = 81000: 81000 ÷ 144 = $562\frac{1}{2}$ feet, Ans.

SECTION LXXIX.

PHILOSOPHICAL PROBLEMS.

2. (p. 331.) 1 × 1 : $\frac{1}{4}$ × $\frac{1}{4}$: : 39.2 : $2\frac{3}{20}$in. Ans.
3. 1 × 1 : 60 × 60 : : 39.2 : 141120in.; 141120 ÷ 12 = 11760; 11760 ÷ 3 = 3920yd. Ans.

4. $39.2 : 100 \times 12 :: 1 \times 1 : 30.6122$; $\surd 30.6122 = 5.53$ seconds, Ans.
5. $2000 + 4000 = 6000$; $6000^2 : 4000^2 :: 900$lb. : 400lb. Ans.
6. $20000 + 4000 = 24000$; $24000^2 : 4000^2 :: 144$lb. : 4lb. Ans.
7. $1 : 2 :: 4000^2 : 32000000$; $\surd 32000000 = 5656.85$; $5656.85 - 4000 = 1656.85$ miles, Ans.
8. $4000^2 : 240000^2 :: 150$lb. : 540000lb. Ans.
9. $400 : 900 :: 4000^2 : 36000000$; $\surd 36000000 = 6000$, $6000 - 4000 = 2000$ miles, Ans.
10. $2180^3 = 10360232000$; $10360232000 \times 494 = 5117954608000$ = cube of the moon's diameter multiplied by its density; $7964^3 = 505119057344$; $505119057344 \times 400 = 202047622937600$ = cube of the earth's diameter multiplied by its density. $5117954608000 : 202047622937600 :: 6 : 236.8+$ feet, Ans.
11. $2654 \times 400 = 1061600 = \frac{2}{3}$ of the earth's semidiameter multiplied by its density; $294415 \times 100 = 29441500 = \frac{2}{3}$ of the sun's semidiameter multiplied by its density; $26347 \times 67 = 1765249 = \frac{2}{3}$ of Saturn's diameter multiplied by his density; $29723 \times 94.5 = 28088235 = \frac{2}{3}$ of Jupiter's diameter multiplied by his density; $726 \times 494 = 358644 = \frac{2}{3}$ moon's diameter multiplied by its density.

$1061600 : 29441500 :: 170$lb. $: 4714.6+$lb. = the man's weight at the sun;
$1061600 : 1765249 :: 170$lb. $: 282.6+$lb. = the man's weight at Saturn;
$1061600 : 28088235 :: 170$lb. $: 449.7+$lb. = the man's weight at Jupiter;
$1061600 : 358644 :: 170$lb. $: 57.4+$lb. = the man's weight at the moon; } Ans.

13. $1^2 : 60^2 = 3600 :: 16$ft. : 10m. 1600yd. Ans.
14. $1^2 : 3600^2 = 12960000 :: 16$ft. : 39272m. 1280yd. **Ans.**

15. $24 \times 60 \times 60 \times 9 = 777600$ = seconds in 9 days; $1^s : 777600^s = 604661760000 :: 16ft. : 9674588160000ft.$; $9674588160000 \div 3 = 3224862720000yd.$; $3224862720000 \div 1760 = 1832308363m.\ 1120yd.$ Ans.

16. $660 \div 8 = 82\frac{1}{2}$; $82\frac{1}{2} \times 82\frac{1}{2} = 6806\frac{1}{4}ft.$ Ans.

17. $1000 \div 8 = 125$; $125 \times 125 = 15625ft.$; $15625 \div 5280 = 2m.\ 5065ft.$ Ans.

18. $200 \div 8 = 25$; $25 \div 4 = 6\frac{1}{4}sec.$ Ans.

19. $320 \div 8 = 40$; $40 \div 4 = 10sec.$ Ans.

20. $\surd 40000 = 200$; $200 \div 4 = 50sec.$ Ans.

21. $\surd 400 = 20$; $20 \div 4 = 5sec.$ Ans.

23. $220 \times 64 = 16080$; $\surd 16080 = 118.659+$; $118.659 \times 2240 \times 4 = 1,063,184.6+lbs.$ Ans.

SECTION LXXX.

MECHANICAL POWERS.

1. (p. 336.) 1ft. : 9ft. :: 170lb. : 1530lb. Ans.

2. 9ft. : 1ft. :: 1530lb. : 170lb. Ans.

3. 170lb. : 1530lb. :: 1ft. : 9ft. Ans.

4. 1530lb. : 170lb. :: 9ft. : 1ft. Ans.

5. $4,000,000,000,000,000,000,000 \times 100 = 400,000,000,000,000,000,000,000$; 200lb. : 400,000,000,000,000,000,000,000lb. :: 6000 miles : 12,000,000,000,000,000,000,000 miles, Ans.

6. 6000m. : 12,000,000,000,000,000,000,000,000m. :: 1in. : 2,000,000,000,000,000,000,000in.; $2,000,000,000,000,000,000,000 \div 12 = 166,666,666,666,666,666,666\frac{2}{3}ft.$; $100ft. : 166,666,666,666,666,666,666\frac{2}{3}ft. :: 1sec. : 1,666,666,666,666,666,666\frac{2}{3}sec.$; $1,666,666,666,666,666,666 \div 60 = 27,777,777,777,777,777m.\ 46\frac{2}{3}sec.$; $27,777,777,777,777,777 \div 60 = 462,962,962,962,962h.\ 57m.$; $462,962,962,962,962 \div 8766 = 52,813,479,690y.\ 17d.\ 14h.\ 57m.\ 46\frac{2}{3}sec.$ Ans.

7. 4ft. = 48in. : 6in. : : 960lb. : 120lb. Ans.
8. 6in. : 48in. : : 120lb. : 960lb. Ans.
9. 120lb. : 960lb. : : 6in. : 48in. = 4ft. Ans.
10. 960lb. : 120lb. : : 48in. : 6in. Ans.
11. 400lb. ÷ 2 = 200lb. Ans.
12. 2 × 3 × 10 = 60lb. Ans.
13. 2 × 2 × 144 = 576lb. Ans.
14. 6in. : 60in : : 1 : 10; 144lb. × 2 × 2 × 10 = 5760lb. Ans.
15. 1000lb. × 10 = 10,000; 10,000 ÷ 50 = 200lb. Ans.
16. 1728lb. × 5 = 8640; 8640 ÷ 600 = $14\frac{2}{5}$lb. Ans.
17. 20000lb. × 50ft. = 1000000; 1000000 ÷ 5280 = $189\frac{1}{3}\frac{3}{3}$lb. Ans.
18. 30 × 2000 = 60000; 60000 ÷ 300 = 200lb. Ans.
19. 5000 × 100 = 500000; 500000 ÷ 1000 = 500lb. Ans.
20. 7000 × 30 = 210000; 210000 ÷ 300 = 700lb. Ans.
21. 1 : 3.141592in. × 10 × 2 × 12 : : 100lb. : 75398.208+lb. Ans.
22. 3.141592 × 2 × 100 : $\frac{1}{2}$in. : : 100000lb. : 79.5774+lb. Ans.
23. $\frac{1}{2}$in. : 3.141592in. × 200 : : 79.5774+lb. : 100,000lb. Ans.
24. 100,000lb. : 79.5774+lb. : : 3.141592in. × 2 × 100 : $\frac{1}{2}$in. Ans.
25. 79.5774+lb. : 100.000 : : $\frac{1}{2}$in. : 628.3184+in.; 628.3184 ÷ 3.141592 = 200in.; 200 ÷ 2 = 100in. Ans.
26. 2 ÷ 2 = 1in. : 20in. : : 100lb. : 2000lb. Ans.
27. .75 : 3.141592 × 16 × 2 × 12 : : 200lb. : 3216990.208lb.; 1.5 ÷ 2 = .75in. : 12in. : : 3216990.208lb. : 51471-84.3+lb. Ans.

SECTION LXXXI.

SPECIFIC GRAVITY.

1. (p. 341.) 10lb. — $6\frac{1}{8}$lb. = $3\frac{7}{8}$lb.; $3\frac{7}{8}$lb. : 10lb. :: 1000oz. : 2608.6+oz. Ans.
2. 18lb. — 16lb. = 2lb.; 15lb. + 18lb. = 33lb.; 33lb. — 6lb. = 27lb.; 27lb. — 2lb. = 25lb.; 25lb. : 15lb. :: 1000oz. : 600oz. Ans.

SECTION LXXXII.

STRENGTH OF MATERIALS.

1. (p. 343.) 200 pounds.
2. 4000 pounds.
3. 4in. : 3in. :: 2000lb. : 1500lb. Ans.
4. 3^3in. : 6^3in. :: 1000lb. : 4000lb. Ans.
5. $2 \times 4^3 : 4 \times 6^3$ :: 1000lb. : 4500lb. Ans.
6. $\frac{2 \times 3^3}{2} : \frac{3 \times 6^3}{4}$ :: 4000lb. : 12000lb. Ans.
7. $\frac{4 \times 6^3}{10} : \frac{8 \times 10^3}{20}$ :: 4 tons : $11\frac{1}{9}$ tons, Ans.
8. $\frac{6^3}{8} : \frac{10^3}{10}$ :: 2000lb. : 7407$\frac{11}{27}$lb. Ans.
9. 1200lb. : 2000lb. :: $\frac{5^3}{15}$ft. : $36\frac{10}{12}\frac{8}{5}$ft. Ans.
10. 3000lb. : 2000lb. :: $\frac{7^3}{8} : 26\frac{1}{8}$; $26\frac{1}{8} \times 6 = 169$; $\sqrt[3]{169}$ = 5.5+in. Ans.
11. 10 tons : 30 tons :: $\frac{2 \times 3^2}{10} : \frac{14}{10}$; $\frac{14}{10} \times \frac{12}{5} = \frac{168}{50} =$ 21.6; $\sqrt{21.6} = 4.64+$in. Ans.
12. $24 \div 2 = 12$; $24 - 4 = 20$; $12^2 : 20 \times 4$ :: 1000lb. : $555\frac{5}{9}$lb.; $555\frac{5}{9}$lb. : 1000lb. :: 1000lb. : 1800lb. Ans.
13. $\frac{6^3}{10} : \frac{10^3}{12}$ :: 2000lb. : 7716.0+lb.; $12 \div 2 = 6$; $6 - 2 =$ 4; $6 + 2 = 8$; 4×8; 6^3 :: 7716.0+lb. : 8680.5+lb. Ans.

SECTION LXXXIII.

ASTRONOMICAL PROBLEMS.

3. (p. 345.) $1841 \div 4 = 460$; $1841 + 460 = 2301$; $2301 \div 7 = 328$, and 5 remainder; $8 - 5 = 3 = C$, Ans.

$1899 \div 4 = 474$; $1899 + 474 = 2373$; $2373 \div 7 =$ 339, and 0 remainder; therefore A, Ans.

5. $1896 \div 4 = 474$; $1896 + 474 = 2370$; $2370 \div 7 =$ 338, and 4 remainder; $8 - 4 = 4 = D$ and E, Ans.

6. $1786 \div 4 = 446$; $1786 + 446 = 2232$; $2232 \div 7 =$ 318, and 6 remainder; $7 - 6 = 1 = A$, Ans.

7. $1837 \div 4 = 459$; $1837 + 459 = 2296$; $2296 \div 7 =$ 328, remainder 0; therefore A, Ans.

OPERATION.

4)1849
462
7)2311
330 — 1
8 — 1 = 7

10.

As 7 remains, the dominical letter will be G; therefore January will begin on Monday, and the 7th day will be the Sabbath. The 7th of December will, therefore, by the rule, be on Friday, and the 8th will be Saturday, Ans.

OPERATION.

4)1857
464
7)2321
331 — 4
8 — 4 = 4

11.

As 4 remains, the dominical letter will be D, and January will begin on Thursday; therefore the 4th day will be the Sabbath, and the 4th of July will be Saturday, Ans.

OPERATION.

4)1890
472
7)2362
337 — 3
8 — 3 = 5

12.

As 5 remains, the dominical letter will be E, and January will begin on Wednesday; therefore the Sabbath will be on the 5th, and the 5th of March will be on Wednesday, and the first day will be Saturday, Ans.

OPERATION.

4)1776
444
7)2220
317 — 1
7 — 1 = 6

13.

As 6 remains, the dominical letters will be F and G; but F will be the dominical letter for July, and the 6th of July will be on Saturday, and the 4th will be on Thursday, Ans.

OPERATION.

4)1874
468
7)2342
334 — 4
8 — 4 = 4

14.

As 4 remains, the dominical letter will be D; therefore January will begin on Thursday, and the 4th day will be the Sabbath, and the 4th of December will be Friday, and the 8th will be Tuesday, Ans.

SECTION LXXXIV.

MISCELLANEOUS QUESTIONS.

1. (p. 347.) $6\frac{2}{3} \div 7\frac{3}{5} = \frac{5}{57}$ Ans.
2. $4\frac{1}{2} \times 2 = 9$; $\sqrt{9} = 3$ Ans.
3. $11\frac{3}{7} \times 5 = 57\frac{1}{7}$ Ans.
4. $9\frac{1}{7} \div 7\frac{3}{4} = 1\frac{51}{217}$ Ans.
5. $\frac{7}{19\frac{3}{5}} = \frac{35}{98} = \frac{5}{14}$ Ans.

6. $\frac{1}{4}$ of a ton = 11cwt. 1qr. 20lb.; $\frac{2}{10}$ of a cwt. = 3qr. $16\frac{4}{5}$lb.; 11cwt. 1qr. 20lb. + 3qr. $16\frac{4}{5}$lb. = 12cwt. 1qr. $8\frac{4}{5}$lb. Ans.

7. 360° : 1° : : 23h. 56′ 3″ : 3′ 59″ 20+‴ Ans.

8. $\frac{\frac{2}{5}}{\frac{7}{8}} = \frac{3}{\cancel{4}_{1}} \times \frac{\cancel{8}^{2}}{7} = \frac{6}{7}$; $9\frac{1}{\frac{5}{6}} = 9 + \frac{1}{\frac{5}{6}}$; $\frac{1}{\frac{5}{6}} = 1 \times \frac{6}{5} = \frac{6}{35}$; $9\frac{6}{35}$

$= \frac{321}{35}$; $\frac{321}{35} \times \frac{6}{7} = \frac{1926}{245}$; $\frac{\frac{7}{8}}{\frac{1}{5}} = \frac{7}{8} \times \frac{5}{1} = \frac{35}{8}$; $8\frac{3}{4} = \frac{35}{4}$;

$\frac{4}{5} \times \frac{35}{8} \times \frac{35}{4} = \frac{245}{8}$; $\frac{1926}{245} \times \frac{245}{8} = \frac{1926}{8} = \frac{963}{4} = 240\frac{3}{4}$ [Ans.

9. $12\frac{5}{7} = 12 + \frac{\frac{5}{12}}{\frac{7}{1}}$; $\frac{\frac{5}{12}}{\frac{7}{1}} = \frac{5}{12} \times \frac{1}{7} = \frac{5}{84}$; $12\frac{5}{84} = \frac{1013}{84}$;

$\frac{2}{5} = \frac{2}{5} \times \frac{10}{9} = \frac{20}{45} = \frac{4}{9}$; $\frac{1013}{84} \times \frac{4}{9} = \frac{1013}{189}$; $\frac{1013}{189} \times \frac{100}{1}$

$= \frac{101300}{189}$; $\frac{\frac{3}{8}}{\frac{11}{12}} = \frac{3}{8} \times \frac{12}{11} = \frac{9}{22}$; $7\frac{1}{5} = \frac{36}{5}$; $\frac{9}{22} \times \frac{36}{5} =$

$\frac{162}{55}$; $\frac{101300}{189} \times \frac{55}{162} = \frac{5571500}{30618} = 181\frac{14821}{15309}$ Ans.

10. $\frac{2}{7} \times \frac{5}{9} = \frac{10}{63}$; $\frac{1}{1} - \frac{10}{63} = \frac{53}{63}$ Ans.

11. As there is a son and a daughter, the son will have $\frac{2}{3}$ of the estate, the wife $\frac{2}{7}$, and the daughter $\frac{1}{7}$. If there had been only a daughter, her share would have been $\frac{2}{3}$; consequently she loses $\frac{2}{3} - \frac{2}{7} = \frac{8}{21}$. Hence

$$\frac{8}{21} : \frac{7}{21} :: \$2400 : \$2100 \text{ Ans.}$$

12. $\frac{12}{13} \times \frac{6}{1} = \frac{72}{13} = 5\text{h. } 32\text{m. } 18\frac{6}{13}\text{sec. Ans.}$

NOTE. — We use the fraction $\frac{12}{13}$, because the minute-hand passes the hour-hand twelve times in thirteen hours.

13. $\frac{1}{3} + \frac{1}{4} = \frac{7}{12}$; $\frac{1}{3} = \frac{4}{12}$; $\frac{1}{4} = \frac{3}{12}$;

$\frac{7}{12} : \frac{4}{12} :: \$100{,}000 : \$57{,}142\frac{8}{7}$ A's part,
$\frac{7}{12} : \frac{3}{12} :: \$100{,}000 : \$42{,}857\frac{1}{7}$ B's part, } Ans.

14. If the first man's share be subtracted from the whole, there will remain $\frac{8}{18} - \frac{7}{18} = \frac{1}{18}$; and $\frac{7}{18}$ of $\frac{1}{18} = \frac{7}{324}$ = the second son's share. And $\frac{7}{18} - \frac{7}{324} = \frac{49}{324}$ = difference of their legacies. $\frac{7}{18} = \frac{126}{324}$; $\frac{126}{324} + \frac{77}{324} = \frac{203}{324}$ = legacy of both sons. Hence $\frac{324}{324} - \frac{203}{324} = \frac{121}{324}$ = wife's legacy. Therefore

$$\frac{49}{324} : \frac{121}{324} :: 257£.\ 3\text{s. } 4\text{d.} : 635£.\ 0\text{s. } 10\frac{30}{49}\text{d. Ans.}$$

15. $68 \times 12 \times 12 \times 1000 \times 3 = 27216000$; $27216000 \div 16 = 1701000$lb.; $1701000 \div 2240 = 759\frac{3}{8}$ tons, Ans.

16. 4ft. = 48in.; 6in. $\times$ 2 = 12in.; 48 — 12 = 36in.; $36 \div 2 = 18$in.; 18 + 12 = 30in.; 48in. : 30in. : : 200lb. : 175lb. Ans. 48 — 30 = 18in.; 48in. : 18in. : : 200lb. : 75lb. Ans.

17. 25ft. 4in. = 304in.; 4ft. 5in. = 53in.; 3ft. 5in. = 41in.; $53 \times 41 = 2173$; $53 - 41 = 12$in.; $12 \times 12 = 144$; $144 \div 3 = 48$; $2173 + 48 = 2221$; $2221 \times .785398 = 1744.368958$; $1744.368958 \times 304 \times 8 = 4242305.305856$; $4242305.305856 \div 1728 = 2455.037792$ = cubic feet in the pillars. $2455.037792 \times 3000 = 7365113.376$ = weight in ounces; $7365113.376 \div 16 = 460319.586$lbs.; $460319.586 \div 2240 = 205.49981+$ tons, Ans.

18. If $\frac{3}{7}$ of a certain sum be taken, and \$410 be left, it is evident that \$410 is $\frac{4}{7}$ of that sum, which is $\overline{410 \times 7} \div 4 =$ \$717½. Now, if \$717½ remain of a certain quantity after ¼ be subtracted, it is certain that the number from which it is taken is ¾ of \$717½ = \$956.66⅔ Ans.

19. $20 \times 19 \times 18 \times 17 \times 16 \times 15 \times 14 \times 13 \times 12 \times 11 = 670442572800$; $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10 = 3628800$; $670442572800 \div 3628800 =$ \$1847.56 Ans.

20. ¼ : \$15.60 : : \$100 : \$6240 = sum remitted; \$96 : \$100 : : \$6240 : \$6500 = value of goods sold; \$6500 — \$6240 = \$260 = commission, Ans.

21. \$107.50 : \$100 : : \$9675 : \$9000; $\frac{9}{10} \times$ \$9000 = 2025£. sterling = the bill; \$100 — \$0.25 = \$99.75; \$100 : \$99.75 : : \$9675 : \$9650.81¼; \$102 : \$100 : : \$9650.81¼ \$9461.58$\frac{3}{4}$ for investment, Ans.

22. $15 \times 30 = 450$; $15 \times 15 = 225$; $225 \div 3 = 75$, $450 + 75 = 525$; $525 \times 220 = 115500$ = contents of the whole monument, and from this we deduct the contents of the cylinder. $15 \times 11 = 165$; $4 \times 4 = 16$; $16 \div 3 = 5\frac{1}{3}$; $165 + 5\frac{1}{3} = 170\frac{1}{3}$; $170\frac{1}{3} \times .785398 = 133.779459\frac{1}{3}$; $133.779459\frac{1}{3} \times 220 = 29431.481053\frac{1}{3}$ = contents of the cylinder; 115500

$-29431.481953\frac{1}{3} = 86068.51894+$ cubic feet of the monument, Ans.

23. $\frac{4}{12} \times 1 + \frac{4}{12} \times \frac{1}{2} + \frac{4}{12} \times \frac{1}{3} = \frac{22}{36}$ A's product;
$\frac{4}{12} \times \frac{1}{2} + \frac{4}{12} \times \frac{1}{3} = \frac{10}{36}$ M's product;
$\frac{4}{12} \times \frac{1}{3} = \frac{4}{36}$ P's product;
$\frac{36}{36}$ sum of the products.

$\frac{36}{36} : \$300 :: \frac{22}{36} : \$183.33\frac{1}{3} =$ A pays,
$\frac{36}{36} : \$300 :: \frac{10}{36} : \$\ 83.33\frac{1}{3} =$ M pays,
$\frac{36}{36} : \$300 :: \frac{4}{36} : \$\ 33.33\frac{1}{3} =$ P pays, } Ans.

24. A $20 \times \$132 = \$2640$
B $25 \times \$120 = \$3000$
C $40 \times \$100 = \$4000$
$85 \qquad \$9640$

$85 \times \$6 = \$510$

$\$9640 : \$510 :: \$2640 : \$139\frac{141}{241}$ A receives,
$\$9640 : \$510 :: \$3000 : \$158\frac{172}{241}$ B receives,
$\$9640 : \$510 :: \$4000 : \$211\frac{148}{241}$ C receives, } Ans.

25. $\$100 \times \$5.00 = \$500$ given for the flour;
$\$500 \times \$0.20 = \$100$ gained on the flour;
$\$600$

$\$100 \times \$0.03{,}0\frac{1}{2} = \$3.05$ bank interest of $\$100$ for 6 months; $\$100 - \$3.05 = \$96.95 : \$100 :: \$600 : \$618\frac{488}{1939}$; $\$618\frac{488}{1939} \div 100 = \$6.18\frac{488}{1939}$ Ans.

26. $5\frac{1}{4} \times 1\frac{7}{8} = \frac{315}{32}$ square yards of broadcloth; $\frac{7}{8} - \overline{\frac{1}{4} \times \frac{1}{4}}$ $= \frac{7}{8} - \frac{1}{16} = \frac{13}{16}$yd. = width of flannel after being shrunk $\frac{315}{32} \div \frac{13}{16} = \frac{5040}{416} = 12\frac{3}{26}$yd. = length of flannel necessary to line the broadcloth if it had not shrunk in length; 19yd. : 20yd. :: $12\frac{3}{26}$yd. : $12\frac{186}{247}$yd. quantity necessary to buy, Ans.

27. $40 \times 2 = 80$ft.; $30 - 2 = 28$ft.; $28 \times 2 = 56$ft.; $80 + 56 = 136$ft.; $136 \times 20 = 2720$ cubic feet; $2720 \times 1728 = 4700160$ cubic inches in the walls of the building; $8 \times 4 \times 2 = 64$ cubic inches in a brick; $4700160 \div 64 = 73440$ bricks, Ans.

28. As the roof projects 1ft. over the plate, it will be 42ft. square; $42 \div 2 = 21$ft.; $21 \times 21 = 441$ft.; $15 \times 15 = 225$ft.; $\sqrt{441 + 225} = 25.8069 +$ feet, being the distance from the top of the house to the plate; $25.8069 \div 2 = 12.9034$ft.; $12.9034 \times 42 \times 4 = 2167.7712$ square feet in the roof; $40 + 40 = 80$ft.; $80 \times 2 = 160$ft.; $160 \times 20 = 3200$ft. required to cover the body of the house; $3200 + 2167.7712 = 5367.7712$ square feet of boards necessary to cover the house, Ans.

29. \$ 300 : \$ 700 : : 20 months : $46\frac{2}{3}$ months, Ans.

30. \$ 1500 ÷ 150 = 10; 10 + 2 = 12 children. \$ 1500 × 2 = \$ 3000; \$ 3000 ÷ 3 = \$ 1000; \$ 3000 + \$ 1000 = \$ 4000; \$ 4000 ÷ 4 = \$ 1000; \$ 4000 + \$ 1000 = \$ 5000; \$ 5000 × 2 = \$ 10,000 Ans.

31. 7 — 5 = 2 miles which B gains each day, and he will have to gain 80 miles before he overtakes A. 2 miles : 80 miles : : 1 day : 40 days, the time which it takes B to overtake A. And as B travels 7 miles each day, he will have to go, before he overtakes A, $40 \times 7 = 280$ miles, Ans.

32. 16lb. : 80lb. : : 24.4in. : 122 cubic inches of lead. $\frac{1}{4} \times 2 = \frac{1}{2}$in.; 1in. + $\frac{1}{2}$in. = 1.5 inches; $1.5 \times 1.5 = 2.25$; $2.25 \times .785398 = 1.7671455$ = area of a section of the pipe. From this we subtract the area of a section of the calibre of the pipe. $1 \times .785398 = .785398$; $1.7671455 - .785398 = .9817475$; $122 \div .9817475 = 124.26+$ inches, Ans.

33. $.785398 \times 2 \times 2 = 3.141592$; $\frac{3}{4} \times \frac{3}{4} \times .785398 = .441786$; $3.141592 - .441786 = 2.699806$; $2.699806 \times 8 = 21.598448$; $\frac{3}{8} \times 2 = \frac{6}{8} = \frac{3}{4}$; $\frac{3}{4} + \frac{3}{4} = 1.5$; $1.5 \times 1.5 = 2.25$; $.785398 \times 2.25 = 1.7671455$; $1.7671455 - .441786 = 1.3253595$; $21.598448 \div 1.3253595 = 16.29+$in. Ans.

34. Let \$ 100 represent the *relative* value of what D pays; then \$ 100 × 1.08 = \$ 108 will represent what C pays; \$ 108 × 1.10 = \$ 118.80, what B pays; and \$ 118 × 1.08 = \$ 133.056, what A pays. \$ 100 + \$ 108 + \$ 118.80 + \$ 133.056 = \$ 459.856.

$459.856 : $100 :: $100 : 21.74\frac{170}{741}$ D pays.
$459.856 : $100 :: $108 : 23.48\frac{162}{741}$ C pays.
$459.856 : $100 :: $118.80 : 25.83\frac{119}{741}$ B pays.
$459.856 : $100 :: $133.056 : 28.93\frac{283}{741}$ A pays.

$20 \times 20 \times 20 = 8000$; $459.856 : $133.056 :: 8000 2314.742006; $\sqrt[3]{2314.742006} = 13.22+$ ft. which A takes $459.856 : $251.856 :: 8000ft. : 4381.47594ft.; $\sqrt[3]{4381.47594} = 16.36+$ ft.; $16.36 - 13.22 = 3.14+$ ft. which E takes. $459.856 : $359.856 :: 8000ft. : 6260.324971ft. $\sqrt[3]{6260.324971} = 18.42$ ft.; $18.42 - 16.36 = 2.06+$ ft. which C takes. $20 - 18.42 = 1.58+$ ft. which remains for D.

36. $18.5 \times 18.5 \times 18.5 \times 8 = 50653$; $\sqrt[3]{50653} = 37$in wide; $8 \times 8 \times 8 \times 8 = 4096$; $\sqrt[3]{4096} = 16$in. deep, Ans

37. As the metal is 1in. thick, the diameter of the inner sphere is 3in.; $5 \times 5 \times 5 \times .5236 \times \frac{128}{500} = 16.8861$lb., weight of the shell, if it were solid iron; $3 \times 3 \times 3 \times .5236 \times \frac{128}{500} = 3.6473976$lb., weight of the inner sphere if it were iron; $16.8861 - 3.6473976 = 13.2387+$lb. Ans.

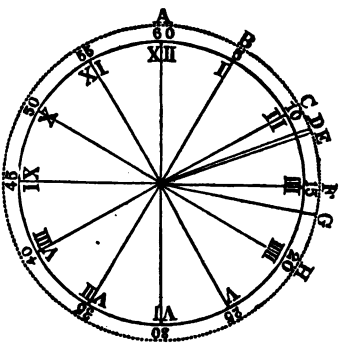
38. By Position.—Suppose the time to be 16 minutes past 2 o'clock, the hour-hand must have passed $\frac{16}{60}$ of the distance from 2 o'clock to 3 o'clock; and if the minute-hand were in the place of the hour-hand, it would be 11m. 20sec. from 12 o'clock. And if the hour-hand were in the place of the minute-hand, the time would be 12 minutes past 3 o'clock. The difference between 12m. and 11m. 20sec. is 40sec. Let these be the first error. Again, suppose the time to be 18 minutes past 2 o'clock; the hour-hand, at that time, has passed $\frac{18}{60}$ of the distance from 2 o'clock to 3 o'clock; and if the minute-hand were in the place of the hour-hand, it would be 11m. 30sec. from 12 o'clock. And if the hour-hand were in the place of the minute-hand, the time would be 36 minutes past 3 o'clock. The difference between 36m. and 11m. 30sec. is 24m. 30sec. = 1470sec. Let these be the second error. Both errors are plus. We now proceed as in the operation:—

$$\begin{array}{rcl} 16 & \times & 40+ \\ 18 & & 1470+ \\ 40 & & 16 \\ \hline 720 & & 23520 \\ & & -720 \\ & & \hline \end{array}$$

$1470 - 40 = 1430)22800(15\text{m. } 56\frac{22}{143}\text{sec. past 2 o'clock,}$ [Ans.

1430
8500
7150
1350
60
1430)81000($56\frac{22}{143}$sec.
7150
9500
8580
920

By Analysis. — Let the annexed diagram represent the face of a clock; A, or 60, the 12 o'clock mark; B, 5 minutes; C, 10 minutes; F, 15 minutes; H, 20 minutes, &c., round the same. Suppose, then, the two hands to be together at A, and then the minute-hand to be moved forward $2\frac{1}{4}$ times round, and it will be at F, having moved 135 minutes; and the hour-hand will have moved to a point, which call D, between C and F. Suppose, then, the minute-hand to be moved still forward to the place required by the supposition, between F and H, which place call G. The hour-hand will then have moved to its place required be-



tween C and F, which place call E. Then, D E being $\frac{1}{12}$ of F G, and F G being $\frac{1}{12}$ of A E, it is evident that D E $= \frac{1}{12}$ of $\frac{1}{12}$ of A E, that is, $\frac{1}{144}$ part of A E; and A D is the other $\frac{143}{144}$ of A E; and so, while the minute-hand moves from A twice round and to G, the hour-hand moves from A to E and while the minute-hand moves from A to E, the hour hand moves from F to G; therefore, as 143 : 144 :: 135m. : $135\frac{135}{143}$m. = 2h. $15\frac{135}{143}$m. = the time at which the hands were in the first position, the minute-hand being $\frac{135}{143}$ of a minute beyond the 3 o'clock mark. Again, $135\frac{135}{143}$m. ÷ 12 $= 11\frac{147}{143}$m. = the minute on the face where the hour-hand was at first. Again, $15\frac{135}{143}$m. — $11\frac{147}{143}$m. = $4\frac{88}{143}$m. = the minutes between the two hands. Again, 60m. — $4\frac{88}{143}$m. = $55\frac{55}{143}$ = the time between the hands changing places; and 2h. $15\frac{135}{143}$m. + $55\frac{55}{143}$m. = 3h. $11\frac{147}{143}$m. = the time on the clock when the hands would have changed places; and $11\frac{147}{143}$m. ÷ 12 = $\frac{135}{143}$ of 1 minute = place of the hour-hand beyond the 3 o'clock mark at the time of changing places, Q. E. D.

39. $20 \times 20 \times 20 = 8000$ cubic inches = contents of the larger cube. $20 \times 20 = 400$; $400 \div 3 = 133.33+$, $\surd 133.\dot{3} = 11.5469+$; $\overline{11.5469}^3+ = 1539.58+$ cubic inches = contents of the smaller cube, Ans.

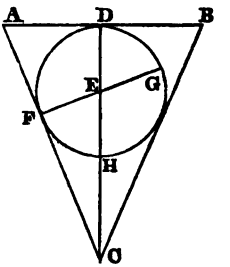
40. $90 \times 40 = 3600$; $\surd 3600 = 60$lb. true weight, Ans. 90 — 60 = 30lb.; 60 — 40 = 20lb.; 30lb. : 20lb. :: 3ft. : 2ft.; that is, the arms of the scales are to each other as 2ft. to 3ft. Ans.

41. Both wheels being of the same height, and the outer wheel making two turns, while the inner one makes only one turn, it will follow, that the outer ring will be twice the diameter of the inner ring. The distance between the rings being 5 feet, and the circumferences of circles being as their diameters, it will also follow, that the diameter of the inner ring will be 10 feet, and the diameter of the outer ring 20 feet.

And if the diameter be 20 feet, the circumference will be 62.83+ feet, Ans.

42. $72 \times 72 \times 3.141598 = 57001$d. $= 237$£. 10s. 1d. Ans.

43. The annexed diagram may represent the conical glass, A B C being the cone, and F D G H a globe or sphere immersed in it. If A B be 5 inches, A D will be 2.5 inches, because A D is half of A B. A D C is a right-angled triangle; therefore the side A C may be found; thus, $\sqrt{AD^2 + DC^2} = AC$; $\sqrt{2.5 \times 2.5 + 6 \times 6} = 6.5 = AC$. Because A D E F is a regular figure, and the angles A D E and A F E being equal, each being a right angle, and the sides D E and F E being also equal, because they are radii of the circle D F H G, the sides A D and A F are also equal. A D is 2.5 inches; A F is also 2.5 inches. If A C be 6.5 inches, and A F 2.5 inches, F C will be 4 inches; $6.5 - 2.5 = 4$ inches. Then, by similarity of triangles (see page 245), C D : D A :: C F : F E; 6in. : 2.5in. :: 4in. : $1\frac{2}{3}$in. = F E. If F E be $1\frac{2}{3}$in., F G will be $3\frac{1}{3}$in. = $\frac{10}{3}$in., because F G is the diameter of the sphere, and F E the radius or semidiameter. By mensuration of solids (see pages 325 and 326), we find the contents of the cone and sphere in the following manner: —



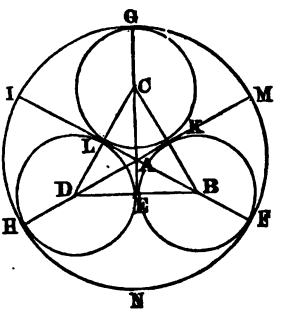
$5 \times 5 \times .785398 \times 2 = 39.2699$in. = contents of the cone;
$\frac{10}{3} \times \frac{10}{3} \times \frac{10}{3} \times .5236 = 19.3925$in. = contents of the sphere;
19.8774in. = the cubic inches of water that will remain in the cone after the sphere is immersed. Having taken it for "granted," that cones, spheres, and all similar solid bodies are to each other as the cubes of their homologous sides, we say, As the quantity of water it requires to immerse the sphere in the *given* cone is to the cube of the diameter of the sphere, so is any other quantity of water in

the conical glass to the cube of the diameter of a sphere that may be immersed in it. Now, the quantity of water given to immerse the *required* sphere is $\frac{1}{5}$ of the contents of the conical glass $= \frac{22 \cdot 2000}{5} = 7.85398$ cubic inches. The cube of the diameter of the *given* sphere is $\frac{10}{3} \times \frac{10}{3} \times \frac{10}{3} = \frac{1000}{27}$in. Therefore

19.8774in. : $\frac{1000}{27}$in. : : 7.85398in. : 14.634114529+in. ;

$\sqrt[3]{14.634114529} = 2.445+$in. Ans.

44. Let the larger circle of the annexed figure represent the farm of the lady, and the three smaller circles the farms of her daughters. To construct this figure, make the equilateral triangle C B D, each of whose sides is 10 rods or inches. Bisect each of the sides D C, C B, B D, in the points L, E, K; and draw the lines I F, E G, F I, at pleasure. Upon the points C, D, B, as centres, and with the distance C L as a radius, describe the circles G L K, L H E, K E F. Upon the point A, as a centre, where the lines I F and H M intersect each other, and with the radius A G, describe the circle G I H N F M, and it will touch the peripheries of the smaller circles without cutting them. The sides of the triangle being 10, the diameter of each of the smaller circles will be 10. Because C D E is a right-angled triangle, $CE = \sqrt{CD^2 - DE^2}$;



$\sqrt{10 \times 10 - 5 \times 5} = 8.660254+$; and as C D E and A D E are similar triangles, C E : C D : : D E : D A ; that is, 8.660254 : 10 : : 5 : 5.7735027 = A D. If we add H D = 5 to D A, we have the semidiameter of the larger circle, 5.7735027 + 5 = 10.7735027. By multiplying this last number by 2, we have the diameter of the larger circle, 10.7735027 × 2 = 21.5470054. As the area of a circle may be found by mul-

tiplying the square of the diameter by .785398, therefore, by dividing the area by .785398, the quotient will be the square of the diameter. The area of the lady's field is 500 acres = 80000 square rods; 80000 ÷ .785398 = 101859.18 square of the diameter; $\surd$ 101859.18 = 319.154006+ rods = diameter of the lady's farm. To find the diameter of each of the daughters' farms, we say, As the diameter of the larger circle in the diagram is to the diameter of one of the smaller circles in the diagram, so is the diameter of the lady's farm to the diameter of either of her daughters' farms. 21.5470054rd. : 10rd. :: 319.154006rd. : 148.119889+rd. = diameter of the daughters' farms; and the distance of their houses from each other, 148.119889 × 148.119889 × .785398 = 17231.2406+ square rods in each of the daughters' farms; 17231.24+rd. ÷ 160 = 107A. 2R. 31.24+ rods = acres, &c., in each of their farms; 107A. 2R. 31.24rd. × 3 = 323A. 0R. 13.72rd. amount of the 3 daughters' farms; 500A. — 323A. 0R. 13.72rd. = 176A. 3R. 26.28rd. the lady retained. To find the distance of the lady's dwelling-house from those of her daughters, we subtract the semidiameter of either of the daughters' farms from that of the lady's; thus, 319.154+rd. ÷ 2 = 159.577+rd.; 148.119+rd. ÷ 2 = 74.059+rd.; 159.577+rd. — 74.059+rd. = 85.518+rd. Ans.

45. $\frac{35\frac{1}{7}}{52\frac{5}{7}} = \frac{\frac{246}{7}}{\frac{369}{7}} = \frac{246}{\cancel{7}} \times \frac{\cancel{7}}{369} = \frac{246}{369} = \frac{2}{3}$; $(\frac{2}{3})^3 = \frac{8}{27}$ Ans.

46. $\frac{78\frac{2}{5}}{264\frac{3}{5}} = \frac{\frac{392}{5}}{\frac{1323}{5}} = \frac{392}{\cancel{5}} \times \frac{\cancel{5}}{1323} = \frac{392}{1323} = \frac{8}{27}$; $(\frac{8}{27})^{\frac{1}{3}} = \frac{2}{3}$ Ans.

47. $\frac{66\frac{2}{11}}{1034\frac{1}{11}} = \frac{\frac{728}{11}}{\frac{11375}{11}} = \frac{728}{\cancel{11}} \times \frac{\cancel{11}}{11375} = \frac{728}{11375} = \frac{8}{125}$; $(\frac{8}{125})^{\frac{1}{3}} = \frac{2}{5}$; $\frac{69\frac{5}{7}}{87\frac{1}{7}} = \frac{\frac{488}{7}}{\frac{610}{7}} = \frac{488}{\cancel{7}} \times \frac{\cancel{7}}{610} = \frac{488}{610} = \frac{4}{5}$; $(\frac{4}{5})^2 = \frac{16}{25}$; $\frac{16}{25} \times \frac{2}{5} = \frac{32}{125}$ Ans.

48. $\frac{14\frac{4}{9}}{21\frac{2}{3}} = \frac{\frac{130}{9}}{\frac{65}{3}} = \frac{\overset{2}{\cancel{130}}}{\underset{3}{\cancel{9}}} \times \frac{\overset{1}{\cancel{3}}}{\underset{1}{\cancel{65}}} = \frac{2}{3}$; $\frac{65\frac{1}{8}}{93\frac{3}{8}} = \frac{\frac{525}{8}}{\frac{745}{8}} = \frac{\overset{7}{\cancel{525}}}{\cancel{8}}$

$\times \frac{\$}{\frac{75}{1}} = \frac{7}{1}$; $\frac{2}{3} \times \frac{7}{1} = \frac{14}{3} = 4\frac{2}{3}$; $\frac{13\frac{1}{2}}{31\frac{1}{2}} = \frac{\frac{27}{2}}{\frac{63}{2}} = \frac{27}{2} \times \frac{2}{63} = \frac{3}{7}$; $\frac{231\frac{1}{4}}{37} = \frac{\frac{925}{4}}{\frac{37}{1}} = \frac{925}{4} \times \frac{1}{37} = \frac{925}{148}$; $\frac{925}{148} \times \frac{3}{7} = \frac{2775}{1036} = 2\frac{703}{1036}$; $4\frac{2}{3} + 2\frac{703}{1036} = 7\frac{289}{444}$ Ans.

49. $648.95 + $10 + $20 + $68.75 = $747.70; 63 + 51 + 60 = 174; $747.70 ÷ 174 = $1.45 per day. $1.45 × 51 = $73.95; $73.95 + $20 = $93.95; $23.15 + $50 = $73.15; $93.95 — $73.15 = $20.80, being what Carleton received. $1.45 × 60 = $87; $87 + 68.75 = $155.75; $17.48 + $50 = $67.48; $155.75 — $67.48 = $88.27, being what Jones received. $20.80 + $88.27 = $109.07; $400 — $109.07 = $290.93; $17.48 + $23.15 = $40.63; $290.93 — $40.63 = $250.30, being what Smith received, Ans.

50. The sum received for reaping the field was 90 shillings. B received 3 shillings 9d. = 3.75s. less than he would have received, if they had not employed C. As A could reap the field in 9 days, he would in 5 days reap $\frac{5}{9}$ of the field, and would therefore receive $\frac{5}{9}$ of 90 shillings = 50 shillings for his labor, and B and C would receive the remainder, 90 — 50 = 40 shillings, and they would reap $\frac{4}{9}$ of the field.

It appears by the question, that B loses 3s. 9d. by employing C. Therefore, as the sum which B receives is to the sum he loses by employing C, so is the sum that A receives to the sum he loses by employing C.

We have here a question in proportion, where we have only the second and third terms given to find the first and fourth. If we knew all the terms, they would be as follows: —

30s. : 3.75s. : : 50s. : 6.25s.

We have neither the 30s. nor the 6.25s. given, but we have the 3.75s. and the 50s. given.

As the product of the extremes is equal to the product of

the means, we know, therefore, the product of the first and fourth terms will be $3.75 \times 50 = 187.5$.

We also know, that the sum of the first and last terms is 36.25; for it is certain that the sum of the first, second, and fourth terms is 40 shillings, and if the second term, 3.75s., be taken from 40, the remainder will be 36.25.

We have now the sum of the first and fourth terms, 36.25, and their product, 187.5, given to find those terms.

By Section XXXV., page 159, of the Arithmetic, we find, that, "If any number be divided into two equal parts and into two unequal parts, the product of the two unequal parts together with the square of half the difference of the two unequal parts is equal to the square of half their sum."

Thus, $36.25 \div 2 = 18.125$, half the sum of the two unequal parts. And $18.125 \times 18.125 = 328.515625$, the square of half the sum.

From this last number we subtract the product of the two numbers, and the remainder must be the square of half the difference of the two numbers. Thus $328.515625 - 187.5 = 141.015625$, the square of half the difference.

And $\sqrt{141.015625} = 11.875$, half the difference of the first and fourth terms.

By adding half the sum of any two numbers to half their difference, we obtain the larger.

Therefore $18.125 + 11.875 = 30$ shillings, the sum B received; and $18.125 - 11.875 = 6.25$ shillings, the sum which A would have received in addition to his 50 shillings, if they had not employed C.

As B receives 30 shillings, C will receive $40 - 30 = 10$ shillings.

30s. : 90s. : : 5 days : 15 days, the time B would reap the field.

10s. : 90s. : : 2 days : 18 days, the time C would reap the field.

OPERATION BY ALGEBRA.

4£. 10s. — 1080d.; 3s. 9d. = 45d. Let x = the time in which B can do the work. Then $9 : x : : 45 : \frac{45x}{9} =$ the sum which C must receive from A in part payment for his labor.

Then $45 + \frac{45}{x}$ = the money received by C for his 2 days labor. Now it is evident that the sum received by C must bear the same proportion to the sum received for the whole work, as the part of the work which he performs bears to the whole work.

Hence $\frac{45 + \frac{45x}{9}}{1080} = \frac{x+9}{216}$ denote the part of the work performed by C. Therefore $\frac{x+9}{216}$ work : 1 work :: 2 days : $\frac{2}{\frac{x+9}{216}}$ $= \frac{432}{x+9}$ = the time in which C would do the whole work. Now, since from the question and the operation we see that A performs $\frac{5}{9}$ of the work, B $\frac{x}{9}$ of it, and C $\frac{x+9}{216}$ of it, it is evident that $\frac{5}{9} + \frac{x}{9} + \frac{x+9}{216} = 1$ work. Or, $\frac{5}{x} + \frac{x+9}{216} = 1 - \frac{5}{9}$ $= \frac{4}{9}$, which, being reduced and transposed, gives $x = 15$ days = the time in which B would reap the field. $\frac{432}{x+9} = \frac{432}{24} = 18$ days = the time in which C would reap the field, Ans.

51. \$ $0.62\frac{1}{2} \times 100 =$ \$ 62.50; \$ $1.00 \times 135\frac{1}{2} =$ \$ 135.50; \$ 62.50 + \$ 135.50 = \$ 198; \$ 630 − \$ 198 = \$ 432; 120 + 96 = 216; 216 : 120 :: \$ 432 : \$ 240; \$ 240 + \$ 62.50 = \$ 302.50 − \$ 210 = \$ 92.50, due to Jenkins. \$ 432 − \$ 240 = \$ 192; \$ 192 + \$ 135.50 = \$ 327.50; \$ 327.50 − \$ 210 = \$ 117.50, due to Betton, Ans.

52. $4 - \frac{1}{8} = 3\frac{7}{8}$; $4 : 3\frac{7}{8} :: 40 : 1\frac{5}{4}\frac{5}{5}$; $1\frac{1}{2}$yd. = 24na.; $24 - 1\frac{1}{2} = 22\frac{1}{2}$na.; 24na. : $22\frac{1}{2}$na. :: $2\frac{1}{4}$yd. : $2\frac{7}{64}$yd. = $1\frac{3}{6}\frac{5}{4}$yd.; $1\frac{5}{4}\frac{5}{5} \times 1\frac{3}{6}\frac{5}{4} = 2\frac{9}{2}\frac{2}{5}\frac{2}{6}\frac{5}{} = 81\frac{1}{2}\frac{8}{5}\frac{8}{6}$yd.; 5qr. = $1\frac{1}{4}$yd.; $20 - 1\frac{1}{4} = 18\frac{3}{4}$yd.; $\frac{18\frac{3}{4}}{20} = \frac{15}{16}$; 5qr. = 20na.; $20 - \frac{1}{2} = 19\frac{1}{2}$; $19\frac{1}{2} \times \frac{15}{16} = 18\frac{8}{32}$na.; $81\frac{1}{2}\frac{8}{5}\frac{8}{6}$yd. = $1307\frac{1}{16}$na., $1307\frac{1}{16} \div 18\frac{8}{32} = 71\frac{7}{13}$yd. Ans.

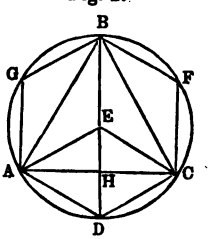
53. $.\dot{1} = \frac{1}{9}$; $(\frac{1}{9})^2 = \frac{1}{81} = .\dot{0}12345679\dot{0}$, Ans.

54. $\frac{6^3}{10} : \frac{10^3}{20}$ :: 1000lb. : 2314.81+lb.; 20 ÷ 2 = 10; 10 − 4 = 6; 10 + 4 = 14; 14 × 6 = 84; $10^2 = 100$; 84 : 100 :: 2314.81+lb. 2755.72lb. Ans.

55. $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10 \times 11 \times 12 \times 13 \times 14 \times 15 \times 16 \times 17 \times 18 \times 19 \times 20 \times 21 \times 22 \times 23 \times 24 \times 25 \times 26 \times 27 \times 28 \times 29 \times 30 \times 31 \times 32 \times 33 \times 34 \times 35 \times 36 \times 37 \times 38 \times 39 \times 40 \times 41 \times 42 \times 43 \times 44 \times 45 \times 46 \times 47 \times 48 \times 49 \times 50 \times 51 \times 52 \times 53 \times 54 \times 55 \times 56 \times 57 \times 58 \times 59 \times 60 \times 61 \times 62 \times 63 \times 64 \times 65 \times 66 \times 67 \times 68 \times 69 \times 70 \times 71 \times 72 =$ 6123445837688608686152407038527467274077809178469732893823014963978384987221689274204160000000000000000 Ans.

56. In performing this question, we first find the ratio which the perpendicular height of an equilateral triangle has to one of its sides. Let A G B F C D be a circle, and E the centre. From the point A in the circumference, apply the radius A E six times to the circumference, and join A G, G B, B F, F C, C D, and D A, and the figure A G B F C D thus formed is an equilateral inscribed hexagon. Join the alternate angles A B, B C, and C A, and the figure A B C thus formed is an equilateral triangle inscribed. It is equilateral because the three sides subtend the equal arches of the circumference.

Fig. 1.



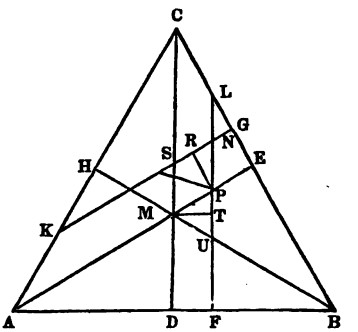
A E C D is a rhombus, and the diagonal E D is equal to either side of the rhombus. If, therefore, the diameter of the circle B D is 1, the semidiameter E D or B E will be .5; and E H, which is half of E D, will be .25. And as B E is .5 and E H is .25, it is evident that B H is .75, or three fourths of B D, and that E H is one third of B H. If, therefore, we wish to find a point in an equilateral triangle which is at equal distances from the angles, we have only to find the perpendicular height of the triangle B H, and then take one third of this distance and set it off from H to E. E then is at equal distances from A, B, and C.

To find the ratio which A B has to B H, we assume A B to be 1; A H, which is half of A C or A B, will be .5. But

A B H is a right-angled triangle, therefore B H is equal to the square root of the difference of the squares of A B and A H. Thus, $BH = \sqrt{AB^2 - AH^2} = \sqrt{1^2 - .5^2} = \sqrt{1 - .25} = \sqrt{.75} = .8660254$. If, therefore, we multiply the side of any equilateral triangle by .8660254, the product will be its perpendicular height. Q. E. D.

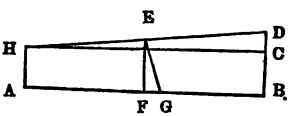
Let A B C be an equilateral triangle, whose sides are 200 feet. Let the tower at A be 30 feet high, the one at B 40 feet high, and the one at C 50 feet. Bisect A B in D, B C in E, and C A in H. Draw C D, B H, and A E. The point M will be the centre of the triangle, and the lines M A, M C, and M B will be equal to each other. The line C D will be $200 \times .8660254 = 173.20508$ feet, and M D will be $\frac{1}{3}$ of $173.20508 = 57.73502$ feet. As the tower at A is 30 feet high, and the one at B 40 feet, we first ascertain a point F, which shall be equally distant from the top of the tower at A, and the top of the tower at B; and this we do by similarity of triangles, thus:—

Fig. 2.



Construct the figure A B D H. Make A B 200 feet, A H 30 feet, and B D 40 feet. Draw H C parallel to A B. B C will be 30 feet, and C D 10 feet. Take the point F at equal distances from A and B; A F or F B will be 100 feet. Draw F E at right angles to A B. It will readily be perceived that E F is 35 feet. Draw E G, making the angle F E G equal to the angle C H D. Then, by similarity of triangles, H C will be to D C as E F to F G; that is, as 200ft. : 10ft. : : 35ft. :

Fig. 3.



1.75ft. = the distance from F to G. Let F (Fig. 2), then, be a point in the line A B, which is 1.75 feet from D. A F will then be 101.75 feet, and F B, 98.25 feet. Draw F L parallel to D C; any point, therefore, in the line F L will be equally distant from the top of the towers at A and B. By a process similar to the above, we find the distance E G to be 2.25 feet. Thus, 200ft. : 10ft. : : 45ft. : 2.25ft. We draw G K parallel to E A; and as the point G is equally distant from the top of the towers at B and C, it is evident, that if any point be taken in the line G K, it will also be equally distant from the summit of said towers. Let this point be N. We have before shown, that any point in the line F L will be equally distant from the top of the towers at A and B. Let this point also be N. Therefore, the point N is equally distant from the summit of the three towers at A, B, and C. S P N is an equilateral triangle, and its perpendicular height R P, which is equal to G E, is 2.25 feet. As we have before found, the ratio of the side of an equilateral triangle to its perpendicular height is as 1 to .8660254; we therefore infer, that the ratio of the perpendicular height of an equilateral triangle is to one of its sides as .8660254 to 1. Then, as .8660254 : 1 : : R P : N P = .8660254 : 1 : : 2.25 : 2.598076 = N P. To find P T, which is half of P U, we say, as .8660254 : .5 : : M T : P T; that is, as .8660254 : .5 : : 1.75 : 1.010362 = P T. We now add F T, P T, and P N together, 57.73502 + 1.010362 + 2.598076 = 61.343458 = N F.

As N F B is a right-angled triangle, N B will be equal to the square root of the sum of the squares of F N and F B. That is, $N B = \sqrt{(N F^2 + F B^2)} = \sqrt{(61.343458^2 + 98.25^2)} = \sqrt{(3763.019839397764 + 9653.0625)} = 115.8277+$.

To find the length of the ladder, which is to extend from the point N to the top of the tower B, as it is the hypothenuse of a right-angled triangle, we square N B, which we have found above to be equal to the sum of the squares of N F and B F = 13416.082339397764, and also square the height of

the tower B = 1600. We find the sum of these squares to be 15016.082339397764. The square root of this number will be a line extending from N to the top of the tower B, which is the length of the ladder required. $\surd$15016.08233-9397764 = 122.54+. To find the line N C, from the square of the length of the ladder we subtract the square of the height of the tower C, and then extract the square root of the remainder. Thus, 15016.082339397764 — 2500 = 12516.-082339397764; $\surd$12516.082339397764 = 111.875+ feet. To find the distance N A, we subtract the square of the height of the tower A from the square of the length of the ladder, and then extract the square root of the remainder. Thus, 15016.082339397764 — 900 = 14116.082339397764; $\surd$14-116.082339397764 = 118.811+ feet. We therefore find the distance from the point N to the first tower A to be 118.811+ feet; to the second tower, B, 115.827+ feet; to the third tower, C, 111.875+ feet. Length of the ladder 122.54+ feet. Ans.

THE END.

POPULAR

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ADAPTED TO ALL GRADES OF PUPILS;

IN THREE BOOKS.

BY BENJAMIN GREENLEAF, A. M.

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IMPROVED STEREOTYPE EDITIONS.

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4. The *reasons* for the operations have been shown, and the learner is led to look into the philosophy of the subject, rather than perform mechanically operations which he does not understand.

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than in any other work of the kind. The principles upon which it depends, and the different modes of operation are fully developed, and its application and use are made perfectly clear to the scholar.

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7. Questions have been inserted at the bottom of the pages, designed to direct the attention of teachers and pupils to the most important principles of the science, and fix them in the mind.

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3. The Custom House business, carefully prepared by officers of the Boston Custom House, the Philosophical and Geometrical Problems, the articles on Banking and Exchange, are full, and have passed under the revision of those who are well acquainted with these respective departments.

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The great popularity of Greenleaf's Arithmetic is indicated by the fact that it is now in general use in the best schools throughout New England, including the several STATE NORMAL SCHOOLS, in Massachusetts, in New York City, and in hundreds of academies and select schools in various sections of the United States.

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The attention of Teachers and Superintendents of Schools, is respectively invited to this popular system of Arithmetic, which is well adapted to all classes of students.

☞ *Copies of the work furnished for examination, on application to the Publisher.*

To those who have not had an opportunity to examine the work, the following testimonials from eminent teachers, indicating some of its peculiar excellences, are submitted:

PHILLIPS ACADEMY, *Andover, May* 15, 1846.

Your "National Arithmetic" has been used as a text book in this Institution for several years. We had previously made trial of several different systems, and the comparison has satisfied us that your work possesses *decided advantages over all others now in use.*

One of the peculiar excellences of your book is, that the examples are so constructed and diversified as to *exhaust the subject.* It would be almost impossible for a pupil to perform your examples in course, and remain ignorant of any of the important principles of the science. Your work is also happily adapted to accomplish a still higher and more important object, — *mental discipline.* There are various other points to which I might allude, as the originality of your examples, their practical character, &c.; but the crowning excellence of your system is, that it *works well* in the school-room.

We have used your "Introductory Arithmetic" in our preparatory department for the last two years, and find it to possess substantially the same valuable qualities that characterize the larger work.

W. H. WELLS,
B. Greenleaf, Esq. *Instructor in English Department.*

From Marshall Conant, Esq., Principal of Framingham Academy, — formerly a Teacher in one of the Public Schools, Boston.

After giving Greenleaf's Arithmetic and Introduction a pretty thorough examination, I concluded to give them a trial; and it has been attended with success. The definitions and rules, both in the National Arithmetic and Introduction, are stated with admirable clearness. A feature of these works, which pleases me much, is *the selection of such examples as fully illustrate the principles, and teach a skilful application of the rules of arithmetic.* The "Mental Arithmetic" by the same author, is well arranged and perspicuous, and goes so far as to prepare the pupil to enter with ease the next work of the series. I particularly like the tables, and the application of them in the latter part of the book. In publishing all the works of this author, I feel that you are doing good service to the cause of education.

Framingham, July 3, 1845. MARSHALL CONANT.

The Mental, Introductory, and National Arithmetics, by Mr. Greenleaf, have been for some time used in the school under my charge; so that, from experience I can speak freely of their merits. The rules are given in clear and precise language; illustrated where necessary by examples; and furnished with so many questions, skilfully varied, as to render it impossible for any one, after fairly going through the series, to be without a competent knowledge of the subject.

These observations apply particularly to the National Arithmetic. Its efficiency is acknowledged wherever it has been used. During the last six years I have had scholars in every stage of progress, and I have invariably found that it furnished all the information which they desired, while by its systematic arrangement the principles of the science were acquired with pleasure and facility. It is superior, in my opinion, to any work now before the public.

JAMES B. BATCHELLER,
Marblehead, April 11, 1846. *Principal of Centre School.*

After a careful examination of Greenleaf's Arithmetic, and comparing it with a library of Arithmetics which I am fortunate enough to possess, I am prepared to say, that as a practical and scientific work, it is the best I have seen; and I can but regard it only as a valuable acquisition to this department of education. The peculiar excellences of the work, consist in the clearness of its arrangement and the omission of a mass of explanation, tending to confuse the pupil, and to defeat what I regard as one great object of education, *the learning of the young to think.* It is a work which should be introduced into all our schools, and I am persuaded that when its merits become known, it will supersede many works of more extensive circulation, but of far less merit. Having felt that an arithmetic prepared for the higher schools, and at the same time adapted to the comprehension of very young pupils, was a great desideratum, I have for a long time desired to see such a work as this which I have now in use in my school.

MOSES WOOLSON,
Bangor, Me., June 15th, 1844. *Principal of the Female High School.*

After a trial of several months, Greenleaf's Arithmetics have been adopted as text-books for the classes in my department of instruction. The general arrangement of the introduction of several of the old modes of working problems omitted by so many of the present time, the numerous examples, the clearness and perspicuity of the rules, and the placing of the answers with the sums, are among the advantages possessed by those works, which in my view justly entitle them to preference.

New York, January 24, 1844. WM. TAYLOR A. M.,
Instructor in Natural Philosophy and Mathematics, Washington Institute.

Having had occasion to examine the several treatises upon Arithmetic used in our best schools, and to select from them one for the use of the pupils of the Commercial Department of the University Grammar School, I found Emerson's 3d part and Greenleaf's National Arithmetic to possess apparently about equal degrees of merit. After having taken several large classes through Emerson's, and several others through Greenleaf's, I have adopted the latter as the permanent arithmetic of my school. ISAAC G. HUBBS, *Commercial and Collegiate School.*
New York, April 9, 1844.

After a careful and rigid examination of Greenleaf's Arithmetic, I do not hesitate to say that it is the *very best* work of the kind extant. I have introduced it into my school, and am delighted with the apparent satisfaction displayed by my pupils.
W. KING, *Classical and English School*, 639 *Broadway.*
New York, October 4, 1843.

I have carefully examined Greenleaf's Introduction and National Arithmetic. They are, in my opinion, better adapted to the purposes of teaching than any other books in this department of science with which I am acquainted. I prefer them to Emerson's series, which I have used during the last eight years, and I have therefore introduced them into my school. CHAS. W. FEEKS, 649 Broadway, N. Y.
New York, October 4, 1843. *Classical and English School.*

I have examined with great care and attention "Greenleaf's National Arithmetic," and have no hesitation in saying, that I think it excels every other work of the kind with which I am acquainted. I have accordingly introduced it into "All Saints' Parochial School," and most cheerfully recommend it to others of my profession.
WM. A. TAYLOR, *Principal of All Saints' Parochial School.*
New York, October 31, 1843.

B. Greenleaf, Esq. Dear Sir: I thank you most heartily for the "National Arithmetic" you presented me some time ago. After a thorough and practical examination of the work, I can truly say it pleases me more than any I have ever used. The youngest scholars are interested, and love to study it; the oldest give evidence of a clearer and better understanding of the subject than they have ever shown before. Having introduced it into my own school, I would cheerfully recommend it to others. Yours, very truly, JOHN JAY GREENOUGH.
New York, September 12, 1843.

I have not only examined Greenleaf's National Arithmetic faithfully, but I have tested its value by use; and I do unhesitatingly pronounce it the best text-book of the kind, that has fallen under my notice, during my entire school-room experience. I shall, hereafter, use no other. JOSEPH MCKEE,
Classical and English Teacher, Madame Chegaray's School.
Union Square, New York, July, 1844.

An attentive examination of Greenleaf's National Arithmetic and the Introduction thereto, has confirmed the favorable opinion I had previously formed from report. The rules, simply yet accurately expressed, the lucid illustrations and copious examples, in fact, the entire arrangement, show them to be works of no ordinary merit, and indicate that they have been prepared by one who is a complete master of the science. I have not the slightest hesitation in giving them a decided preference to any works of the kind I have hitherto seen.
M. J. O'DONNELL, *Principal of Public School, No.* 11.
New York, November 22, 1844.

I have examined, with some care, Mr. Greenleaf's Arithmetic, and, by that examination, imperfect as it was, am forced to the conclusion, that on several accounts, it preferable to most, if not all other works on that subject, that I have seen.
JAMES N. MCELLIGOTT, *Principal of the Mechanic Society School.*
New York, January, 1844.

GREENLEAF'S NATIONAL ARITHMETIC is now used as a text-book in the following important seminaries of learning, among others, which fact may be considered a high recommendation for the work.

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The *Normal Schools* in New York City; Rutger's Female Institute, New York; Brooklyn (N. Y.) Female Academy; Abbott Female Academy, and Phillips Academy, Andover; Chauncey Hall School, Boston; Bradford Female Seminary, (Mass.) Miss Hasseltine, Principal; Phillips Academy, Exeter; the Young Ladies' Institute, Pittsfield; Williams Academy, Stockbridge; Worcester County High School, Worcester; Catholic College, Worcester; Wesleyan Academy, Wilbraham; Amherst Academy; Quaboag Seminary, Warren; Framingham Academy; Hingham Academy; Portland Academy; Peirce Academy, Middleborough; Partridge Academy, Duxbury; Lowell Academy; Bristol Academy, Taunton; New Bedford Academy; Rev. D. Leach's Select School, Roxbury; Putnam High School, Newburyport; Friends' Academy, Providence; Kimball Union Academy, Meriden, (N. H.;) Pembroke Academy; New Hampton Academy; Keene Academy; Hillsboro' Academy; Mount Cæsar Seminary; Belfast Academy; Thetford Academy; Caledonia County Grammar School; the High Schools or Academies in Woodstock, Middlebury, Rutland, Montpelier, Burlington, Bradford, and many other towns in Vt.; the High Schools in Hallowell, Augusta, Waterville and Bangor, and many other distinguished institutions in various parts of the United States; and wherever the work has been introduced, *it is still used with great success*, — which is deemed a sufficient recommendation.

The whole or a part of this series, has been recommended and adopted by the superintending school committees of the principal towns throughout New England, including Andover, Haverhill, Newburyport, Salem, Beverly, Lynn, Portsmouth, Worcester, Springfield, Northampton, Pittsfield, Taunton, Fall River, Pawtucket, Bristol, Marblehead, Duxbury, Kingston, Plymouth, Weymouth, Hingham, Milton, Barnstable, Ipswich, Danvers, Brookline, Newton, Watertown, Medford, Quincy, Dedham, Nashua, Manchester, Concord, Fitzwilliam, Keene, Portland, Bangor, Belfast, Hallowell, Augusta, Waterville, Hartford, Norwich, and in the best public and private schools in various sections of the United States.

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St. Luke's School,	George A. Rogers,	"
Female Academy,	Mrs. Page,	"
Classical and English School,	James Lawson,	"
Brooklyn Female Academy,	A. Crittenden,	"
Select School for Young Ladies, (Brooklyn,)	A. Greenleaf,	"
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☞ This system of Arithmetic is also *the text book* in the "*Normal School* male and female,) under the supervision of the Public School Society, and in *Ward Schools* in the City of New York, and in various parts of the State.

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As I looked over the "Practical Elocutionist" of Mr. Maglathlin, I found my old Whateleian prejudices against rules for utterance vanish. The practical, intelligible, and valuable nature of the rules in this little book makes it the only thing I have ever seen which I thought would help either teacher or scholar in our common schools in learning to read well.

From Levi Reed, Principal of the Washington School, Roxbury, Mass., and President of the Norfolk County Teachers' Association.

I have examined "The Practical Elocutionist" with much satisfaction, and am happy to say that I like its plan and matter. A brief manual of vocal culture, like this, has been much needed, and I have no doubt, that, in the hands of a skilful teacher, it may be used with the happiest results.

From C. C. Chase, A. M., Principal of the High School, Lowell, Mass.

I know of no work on the subject of Elocution which I can more highly recommend than "The Practical Elocutionist."

From W. B. Wait, Principal, and H. A. H. Wait, Preceptress, of Melrose Academy, near Boston, Mass.

"The Practical Elocutionist" is, as it should be, brief; but being, throughout, definite, lucid, and thoroughly practical, it is abundantly full and comprehensive. It seems to us exactly adapted to supply our public schools and academies with what many excellent teachers have hitherto regarded as a great desideratum. Having introduced it into the institution under our charge, and had opportunity to test its merits by actual use, we are prepared to give the work our highest commendation.

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The publisher trusts that the improvements contained in the present edition will render the work more acceptable, and give it a still wider circulation.

The following RECOMMENDATIONS have been selected from a large number of valuable notices from the most respectable sources:

From J. W. Bulkley, Esq., Teacher, Albany.

I have examined "Parker's Exercises in Composition," and am delighted with the work. I have often felt the want of just that kind of aid that is here afforded. The use of this book will diminish the labor of the teacher, and facilitate the progress of the pupil in a study that has hitherto been attended with many trials to the teacher, and perplexities to the learner.

If Mr. Parker has not strewed the path of the student with flowers, he has "removed many stumbling-blocks out of the way, made crooked things straight, and rough places smooth." It is certainly one of the happiest efforts that I have ever seen in this department of letters, — affording to the student a beautiful introduction to the most important principles and rules of rhetoric; and I would add, that if carefully studied, it will afford a "*sure guide*" to written composition. I shall use my influence to secure its introduction to all our schools.

From Rev. Samuel P. Newman, Professor of Rhetoric in Bowdoin College.

I have examined "Progressive Exercises in English Composition," by R. G. Parker, with much care, and hesitate not to express an opinion that it is well adapted to the purpose for which it is designed. It is well fitted to call into exercise the ingenuity of the pupil, to acquaint him with the more important principles and rules of rhetoric, and to guide and aid his first attempts in the difficult work of composition.

From Walter R. Johnson, Esq., Franklin Institute, Philadelphia.

Having often felt the necessity of reducing to its simple elements the art of composition, and having been compelled, from the want of regular treatises, to employ graduated exercises expressly prepared for the purpose, and similar in many respects to those contained in this treatise, I can speak with confidence of their utility, and do not hesitate to recommend them to the attention of teachers.

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